RISK AND RETURN IN DOMESTIC AND FOREIGN STOCK TRADING: THE GCC PERSPECTIVE

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

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Declaration

I certify that except where due acknowledgement has been made, the work is that of the author alone; the work has not been submitted previously, in whole or in part, to qualify for any other academic award; the content of the thesis is the result of work which has been carried out since the official commencement date of the approved research program; any editorial work, paid or unpaid, carried out by a third party is acknowledged; and, ethics procedures and guidelines have been followed.

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List of Abbreviations

AACR	Average annual compound rate return
ADF	Augmented Dickey–Fuller
ADR	American Depositary Receipt
ADX	Abu Dhabi Securities Exchange
AED	Arab Emirates dirham
AGS	Ashely, Granger and Schmalenise
AIC	Akaike’s Information Criterion
ATS	Automated trading system
BAH	Bahrain
BHB	Bahrain Bourse
BHD	Bahraini dinar
BIC	Bayesian Schwarz information criterion
BSE	Bahrain Stock Exchange
CBB	Central Bank of Bahrain
CMA	Capital Markets Authority
CPI	Consumer price index
CR	Confusion Rate
DA	Direction accuracy
DF	Dickey–Full
DR	Direction accuracy
DSM	Doha Securities Market
DW	Durbin–Watson
ECM	Error Correction Model
ECT	Error correction term
ETF	Exchange traded funds
FAK	Fill-and-kill
FIFO	First in, first out
FOK	Fill-or-kill
FPE	Final prediction error
FTG	First Telecommunications Group
GBP	British pound
GCC	Gulf Cooperation Council

GDP	Gross domestic product
GTD	Good-Til-Date
HIBOR	Hong Kong interbank offered rate
ICB	International classification benchmark
IFC	International Finance Corporation
IPI	Industrial production index
IMF	International Monetary Fund
IPO	Initial public offerings
JPY	Japanese yen
KPSS	Kwiatkowski–Phillips–Schmidt–Shin
KSA	Kingdom of Saudi Arabia
KSE	Kuwait Stock Exchange
KUW	Kuwait
MAE	Mean absolute error
MSE	Mean square error
MSM	Muscat Securities Market
OLS	Ordinary least squares
OMN	Oman
OMR	Omani rial
OPEC	Organization of the Petroleum Exporting Countries
PP	Phillips–Perron
QAR	Qatar
QIA	Qatar Investment Authority
QSE	Qatar Stock Exchange
RMSD	Root mean square deviation
RMSE	Root mean square error
SAOC	Muscat Clearing & Depository Company
SAR	Saudi Arabian riyal
SB	Settlement Bank
SC	Schwarz Criterion
SGF	Settlement Guarantee Fund
SOM	Special orders market
SSE	Saudi Stock Exchange
SSM	Saudi Securities Markets

STII	Straits Time Industrial Index
TAL	Trading-at-Last
TAS	Tadawul All Share
UAE	United Arab Emirates
UK	United Kingdom
US	United States
VAR	Vector autoregression
VD	Variance reduction
VR	Variance ratio
WFE	World Federation of Exchanges
WTI	West Texas Intermediate

Summary

The objectives of this research are to (i) measure return and risk in domestic and foreign stock trading; (ii) determine whether international diversification provides better risk-return trade-off than domestic markets; and (iii) provide a comprehensive empirical investigation of various aspects of Gulf Cooperation Council (GCC) stock markets.

Many studies have been conducted to determine whether simple trading rules are profitable. The motivation for these studies has largely been an offshoot of investigations into the efficiency of financial markets. If financial markets were efficient, simple trading rules could not consistently produce profit over and above what is produced by a passive buy-and-hold strategy. There has been mixed evidence on this issue.

Despite a wealth of empirical research on whether and how international diversification affects performance, it remains one of the major unresolved research questions in the fields of strategy and international investment. It is proposed that the lack of consensus on the nature of international diversification results from a failure to grasp this complex phenomenon. This study provides a more focused and comprehensive perspective of the activities that define the geographical scope of GCC economies that we hope will motivate a conceptualisation of international diversification.

Chapter 2 presents an overview of the GCC economies and stock markets. Chapter 3 discusses the relation between stock prices and exchange rates in GCC countries. The empirical work is based on time series for exchange rates and stock prices. In Chapter 4,

in-sample forecasts for a variety of exchange rates are generated using the flexible-price monetary model and the naïve random walk model. Chapter 5 describes the methodology used for testing the macroeconomic determinants of GCC stock prices. The methodology is applied to GCC stock prices using seven macroeconomic variables. In Chapter 6, simple trading rules are analysed and applied to historical sample data series on GCC stock prices and exchange rates. Chapter 7 presents the theory and empirical evidence pertaining to the benefits of international portfolio diversification, as well as an empirical investigation of the benefits of international portfolio diversification when investing in GCC countries. In Chapter 8, the exchange rate factor is introduced by considering the rate of return on domestic market and foreign market when they are measured in domestic currency terms. Chapter 9 presents concluding remarks.

Statement of Authorship

Except where reference is made in the text of the thesis, this thesis contains no material published elsewhere or extracted in whole, or in part, from a thesis submitted for the award of any other degree or diploma.

No other person's work has been used without due acknowledgment in the main text of the thesis.

This thesis has not been submitted for the award of any degree or diploma in any other tertiary institution.

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Chapter 1: Introduction and Background

1.1 Introduction

There appears to be a consensus in the finance literature that international diversification leads to more efficient portfolios (in terms of the risk-return criterion) than purely domestic portfolios. More specifically, it is envisaged that international diversification presents a lower risk and/or higher return than investment in domestic assets. The underlying idea is that effective diversification requires low return correlations of the constituent components of a diversified portfolio. As stock returns are less highly correlated across countries than within one country, it follows that international diversification is more effective than diversification within one country.

This proposition made sense in the 1960s and 1970s, when markets were segmented and capital controls and other impediments were imposed to restrict capital outflows and foreign ownership of domestic stocks. These factors made cross-country stock returns weakly correlated. Hence, although there was limited scope for international diversification, diversification across countries was considered useful. However, since the advent of globalisation and the removal of restrictions on foreign investment in domestic markets and domestic investment in foreign markets, stock returns have been highly correlated. This has reduced the effectiveness of international diversification, particularly among developed countries. For this reason, some advocates of international diversification believe that diversification into emerging markets can be useful, at least relative to diversification into developed markets.

If international diversification is as useful as it is typically portrayed to be, why do investors worldwide exhibit strong home-country bias and the tendency to assign a heavy weight to domestic stocks in any internationally diversified portfolio? Although several explanations have been put forward to resolve the ‘home-bias puzzle’, a more intuitive explanation is that international diversification does not pay off or is not effective in reducing risk.

The objective of this study is to measure return and risk in domestic stock trading, foreign stock trading and mixed portfolios to determine whether international diversification is effective. The study will be conducted from the perspective of the member countries of the Gulf Cooperation Council (GCC), which is a regional bloc that comprises Kuwait, Saudi Arabia, United Arab Emirates (UAE), Bahrain, Qatar and Oman. All of these countries peg their currencies to the United States (US) dollar, except Kuwait, which pegs to a basket of currencies. The foreign markets that will be considered are those of the US, United Kingdom (UK) and Japan. This study involves forecasting-based trading, which requires the estimation of three forecasting models for domestic stock prices, foreign stock prices and exchange rates.

1.2 International Diversification

Early studies of international diversification were conducted in the 1960s and 1970s and were overwhelmingly supportive of the benefits of international diversification. Grubel (1968), Levy and Sarnat (1970), Grubel and Fander (1971), Solnik (1974), Lassard (1976) and Biger (1979) demonstrated that international diversification provides US investors with a lower risk for a given level of expected return. For example, Grubel (1968) found that US investors would have achieved better risk-return opportunities by investing part of their portfolio in foreign stock markets during 1959–1966. Levy and Sarnat (1970) demonstrated the diversification benefits from investing in both developed and developing stock markets during 1951–1967.

Several scholars have advocated diversification into emerging markets. For example, Conover et al. (2002) suggested that emerging equity markets are a worthy addition to a US investor's portfolio of developed market equities. Specifically, they found that portfolio returns increased by approximately 1.5 percentage points a year when emerging country equities were included in the portfolio. Similarly, Russel (1998) stated that 'even the relatively risky practice of investing in emerging markets has been viewed, by some, as a sound investment strategy for individuals'. Goetzmann et al. (2005) argued that globalisation has resulted in limiting the benefits of diversification to the extent that they can best be achieved by investing in emerging markets. Driessen and Laeven (2007) found that investors in developing countries receive the most benefits from investing abroad. The implication of these studies is that the benefits of portfolio diversification accrue for investors from developed countries diversifying into emerging markets and investors from emerging countries diversifying into developed markets.

Several studies have been conducted on the phenomenon of home bias. Lewis (2006) described the tendency of investors to select a disproportionately high weight for domestic securities, thus foregoing the gains of international diversification, as 'one of the most enduring puzzles in international macroeconomics and finance'. French and Poterba (1991) found that the significant home bias cannot be explained in terms of capital controls, tax burden and transaction costs. Baxter and Jermann (1997) argued that 'while recent years have witnessed an increase in international diversification, holdings of domestic assets are still too high to be consistent with the theory of portfolio choice'.

Some researchers have cast doubt on the benefits of international diversification and suggested it as an explanation for home bias. For example, Kalra et al. (2004) found that there are fewer benefits of international diversification than previously thought. Their findings showed that a small allocation of 10 per cent to international securities may be justified, and that even the slight advantage of international diversification may disappear when taxes are incorporated in the evaluation. They also argued that to maintain the intended diversification, periodic rebalancing of the portfolio is necessary to keep the domestic and foreign component weights at target levels, as suggested by Rowland (1999) and Laker (2003). However, international investment (particularly in emerging markets) involves non-trivial transaction costs that need to be considered when estimating portfolio performance. Thus, in the presence of periodic rebalancing and associated transaction costs, international diversification does not pay off. On the basis of her results, Lewis (2006) concluded that 'the benefits to diversification have declined both for stocks inside and outside the US'.

More recently, Moosa and Al-Deehani (2009) tested the proposition that international diversification is effective in reducing risk. Their analysis of more than 100 portfolios involving developed and emerging markets showed that correlations are not adequately low to produce effective diversification when long positions are taken. In a few cases involving developed markets only, correlations are high to the extent that taking opposite positions (long and short) produces effective diversification. These results cast doubt on the effectiveness of international diversification in reducing risk. Moosa and Ramiah (2014) and Moosa et al. (2014) reached similar conclusions.

1.3 Relation between Stock Price and Macroeconomic Variables

Typically, the following macroeconomic factors are considered to affect stock prices: economic activity, interest rate, money supply, consumer price inflation, exchange rate and foreign stock price. In the case of GCC countries, two more variables may be added: government expenditure and oil prices. In general, macroeconomic variables affect stock prices because they affect the variables in the dividend discount model.

An early study by Fama and Schwert (1977) showed that macroeconomic variables influence stock prices. Using error correction modelling, Maysami and Sims (2002) analysed short- and long-run relations between macroeconomic variables and stock returns in Hong Kong and Singapore. The macroeconomic variables included money supply, interest rate, consumer price inflation, exchange rate and real economic activity. The results showed that macroeconomic variables affect stock prices with varying degrees of intensity.

The money supply is one of the most effective tools that can influence stock prices. Sellin (2001) suggested that this variable affects stock prices when monetary policy is expected to change. According to Sellin (2001), an increase in the money supply leads people to anticipate higher inflation and interest rates, and both of these factors have a negative effect on stock prices. Conversely, Sellin (2001) also indicated that an increase in the money supply could cause a stock price rise.

Empirical studies of causality between interest rates and stock prices have produced conflicting results, although, in theory, stock prices and interest rates should be negatively related. Mok (1993) tested for causality between stock prices and the Hong Kong interbank offered rate (HIBOR) for the period 1986–1991 and found that the stock price and the HIBOR are independent series. However, Wu's (2001) study of causality between the interest rate and the Straits Time Industrial Index (STII), which used a monthly distributed-lag model, reached a different conclusion. Wu (2001) found that the interest rate significantly influences the STII on a monthly investment horizon. Moreover, a study by Al-Abudljader and Al-Muraikhi (2011) showed that interest rates have a negative effect on stock prices for different reasons that reflect the channels of causation or the transmission mechanism.

Economic theory also shows the interaction between stock prices and exchange rates. Dornbusch and Fisher (1980) argued that exchange rate movements lead to stock price movements according to 'flow-oriented' models. In contrast, Nieh and Lee (2001) examined causality between stock prices and the exchange rate for G7 countries and found that there is no long-run equilibrium relation between the exchange rate and stock prices for those countries. However, they also found a significant relation between the exchange rate and stock prices in the short run.

In early research about the relation between the consumer price index (CPI) and stock prices, Fisher (1930) found that real stock returns are influenced by consumer prices because stocks represent claims against real assets, which means that they should offer a hedge against inflation. Subsequent empirical studies have focused on stock returns over short horizons. However, Boudoukh and Richardson (1993) considered long-term interactions and found that normal stock returns and inflation are not correlated for short horizons, but that Fisher's equation still holds for long horizons.

1.4 Forecasting Accuracy and the Meese–Rogoff Puzzle

Meese and Rogoff (1983a) suggested that exchange rate determination models cannot outperform the random walk model, which means that the best forecast for the exchange rate is today's level, or that the expected change is zero. This proposition is equally applicable to stock prices and financial prices in general. If this is the case, forecasting-based trading is unlikely to be more profitable than trading on the assumption of zero change.

Believing that this is a puzzle, economists have put forward several explanations for Meese and Rogoff's finding. Meese and Rogoff (1983a) explained the puzzle in terms of econometric problems such as simultaneous equation bias, sampling errors, stochastic movements in the true underlying parameters, model misspecification, failure to account for nonlinearities, and the proxies used for inflationary expectations. Many economists have supported the model-inadequacy proposition that structural exchange rate models do not provide a valid representation of exchange rate behaviour in practice (e.g., Cheung and Chinn 1998). Many other explanations have been suggested to resolve the puzzle, as will be discussed later.

The main reason underpinning, and the root cause of, the Meese–Rogoff puzzle has been overlooked in the literature. Assessing forecasting accuracy exclusively by the magnitude of the forecasting error (as Meese and Rogoff did) may explain why the random walk model cannot be outperformed. In fact, the exchange rate models should produce smaller forecasting errors than the random walk model (Moosa and Burns 2013). It has been demonstrated that other explanations for the puzzle, such as those suggested by Meese and Rogoff themselves, cannot explain the puzzle (e.g., Moosa and Burns 2014).

1.5 Data Description

The empirical work conducted in this thesis is based on monthly data covering the period 1 January 2000 to 31 December 2013 on exchange rates, stock prices and the corresponding macroeconomic variables. Data series were collected from various sources, including Datastream, International Financial Statistics, and central banks and stock exchanges of the GCC countries. In one case only (that of Bahrain), monthly data could not be found for government expenditure and interest rates. As a result, interpolation was used to convert quarterly into monthly series. For this purpose the interpolation procedure in STATA 8.0 was used.

1.6 Outline of the Study

The objectives of this research are to (i) measure return and risk in domestic and foreign stock trading; (ii) determine whether international diversification provides a better risk-return trade-off than domestic markets; and (iii) provide a comprehensive empirical investigation of various aspects of GCC stock markets.

Chapter 2 presents an overview of the GCC economies. The chapter describes the economic indicators and statistics, as well as the development of the GCC stock markets and some historical events.

Chapter 3 outlines the relation between stock prices and exchange rates in GCC countries. The empirical work conducted for this purpose is based on time series for exchange rates and stock prices. Although these financial prices behave in a similar fashion, as they are driven by news and other factors, there is a notable difference in their behaviour. Stock prices tend to move along a secular upwards trend arising from the growth and development of the economy, but this secular trend is interrupted by cycles of bear and bull markets. Conversely, exchange rate movements are dominated by cycles and exhibit no long-run trends. Unless a country is experiencing hyperinflation, its exchange rate cannot fall or rise without bounds over a long period. This is particularly the case for GCC currencies, which are pegged to the US dollar, except for the Kuwaiti currency, which is pegged to a basket of currencies. Therefore, it is of interest to determine whether changes in stock prices cause changes in exchange rates, or vice versa.

In Chapter 4, in-sample forecasts for a variety of exchange rates are generated using the flexible-price monetary model and the naïve random walk model, which is one of the models used by Meese and Rogoff (1983a). The accuracy of the forecasts generated by these models is assessed using the conventional methodology applied by Meese and Rogoff.

Chapter 5 describes the methodology used for testing the macroeconomic determinants of GCC stock prices. The chapter begins with unit root testing and the concept of stationarity. This is followed by cointegration and error correction, and then the fundamentals of the Granger representation theorem and causality testing. The methodology is applied to GCC stock prices using seven macroeconomic variables: money supply, interest rate, CPI, government expenditure, oil revenue, foreign stock price and exchange rate.

In Chapter 6, simple trading rules are analysed and applied to historical sample data series on GCC stock prices and exchange rates. This is by no means the only available trading rule, but it is the most common. Basic trading rules are mechanical in nature. The transactions are conducted according to the buy-and-sell signals generated by the underlying trading rule, starting with a buy signal and ending with a sell signal. When a buy signal is generated, the underlying asset and the position is kept until a sell signal is generated. At this time, the asset is sold and a position in the domestic currency is restored. Nothing is done until a buy signal arises again, and then the process is repeated. Naturally, a transaction is profitable if the selling price is higher than the buying price, and vice versa. At the end of trading (the last sell transaction), the net profit generated from trading throughout the sample period is calculated.

Chapter 7 details the theory and empirical evidence pertaining to the benefits of international portfolio diversification. The chapter reviews the literature on the benefits of international diversification for emerging markets, GCC markets and developed markets. The empirical evidence on the benefits of international portfolio diversification is categorised into three sections: studies that do not support portfolio diversification across developed markets, studies that support portfolio diversification across developed markets and studies that investigate the benefits of portfolio diversification across emerging markets. Chapter 7 also empirically investigates the benefits of international portfolio diversification when investing in GCC countries. Two methodologies are applied in Chapter 7. The first is variance reduction and second methodology is variance ratio. The effectiveness of international diversification is investigated without the exchange rate factor, concentrating on the presumed risk-reduction benefits.

Chapter 8 introduces the exchange rate factor by considering the rate of return on domestic and foreign markets when they are measured in domestic currency terms. Chapter 9 presents the concluding remarks.

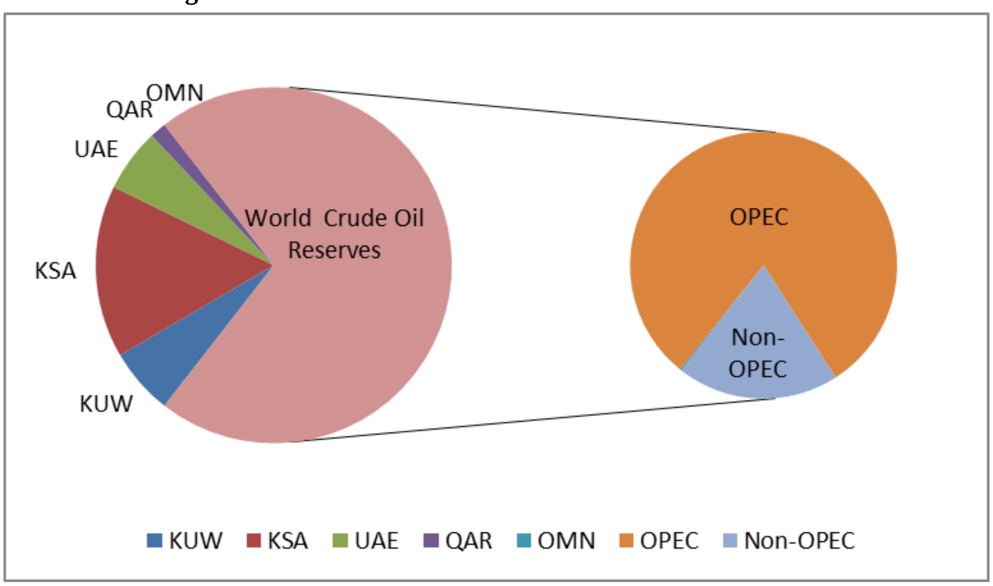
The contribution of this thesis is the provision of empirical evidence on a variety of topics as applied to the GCC stock markets. In general this study provides evidence on the risk-return trade-off as well as evidence indicating that the Meese-Rogoff puzzle is not really a puzzle in the sense that the random walk can be outperformed by the flexible-price monetary model of exchange rates when criteria other than the root mean square error are used to evaluate forecasting accuracy. Further evidence is provided on the determinants of stock prices in small oil-exporting countries and the benefits of international diversification with and without the exchange rate factor. On the practical side this study develops trading rules that may prove to be useful for practitioners.

Chapter 2: Background *Information* on GCC Economies and Stock Markets

2.1 GCC Economic Overview

The economies of GCC countries depend on gas and oil to a significant extent. The GCC includes both oil-rich economies in the Arab Gulf region, such as Kuwait, the UAE, Saudi Arabia, Qatar and Oman, and the resource-scarce country of Bahrain. In addition, a recent report published by OPEC on GCC countries have the largest proven crude oil reserves in the world, with around 537.8 billion barrels. This represents 41.74 per cent of the world's total. In comparison, the Organization of the Petroleum Exporting Countries (OPEC) accounts for 80 per cent of the world's total proven crude oil reserves (see Figure 2.1).

Figure 2.1: GCC Share of World Crude Oil Reserves: 2014



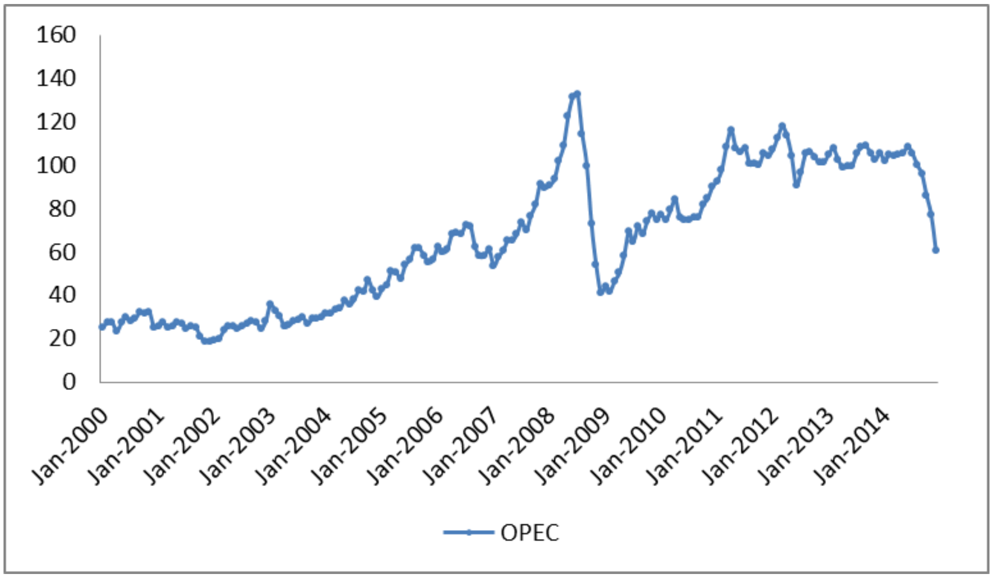
Source: International Monetary Fund (IMF)

The GCC region is the largest producer and exporter of crude oil in the world. GCC countries play a leading role in OPEC in particular and the world in general. In addition, they have enjoyed a staggering boom in economic activities in the past two decades. The combined size of the economies of the GCC countries is estimated at US$1.6 trillion. The gas and oil sectors represent more than 75 per cent of total export revenue and roughly 68 per cent of government revenue, while contributing approximately 45.9 per cent of gross domestic product (GDP).

Figure 2.2 shows the monthly average crude oil prices of the OPEC basket for the period January 2000 to December 2014. The OPEC basket is a weighted average of the prices of oil blends produced by OPEC countries, and it is used as an important benchmark for crude oil prices. At the end of 2014, the average price of the OPEC basket was around US$60.70 per barrel, which was a decline of 42.5 per cent from US$105.48 per barrel in 2013 (see Figure 2.2). The decline in the oil price was attributed to four main reasons:

1. A decline in global demand for oil as a result of weak economic activity, improved technology and efficiency, and an increasing move away from petroleum to other resources, such as solar energy and other fuels.
2. There was turmoil in Libya and Iraq—large oil producers in the region that produce approximately four million barrels per day. The oil markets are more optimistic about the geopolitical risks.
3. The US had become one of the biggest oil producers, which meant that it imported less than it had previously done.
4. The Gulf countries had decided not to reduce their market shares to restore the price.

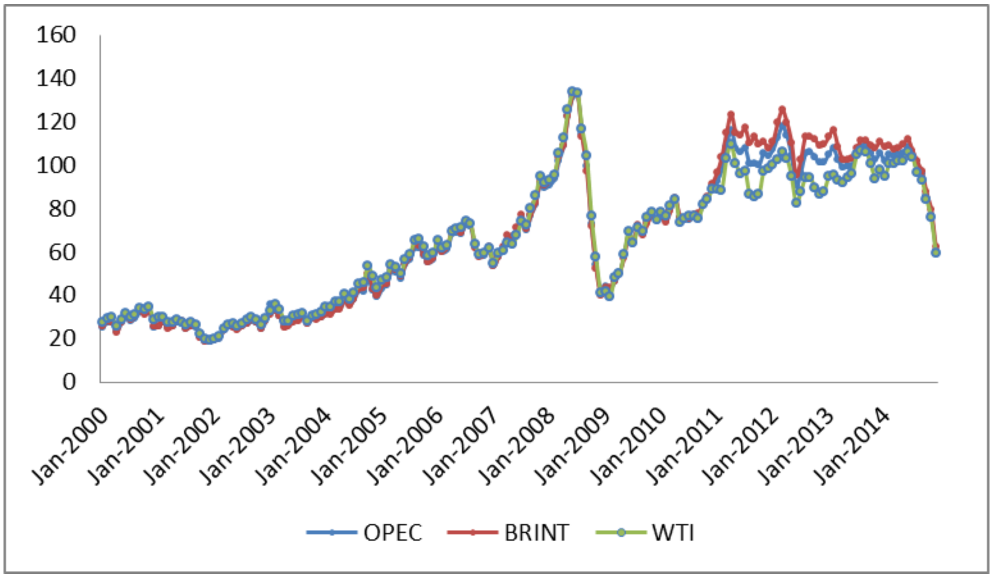
Figure 2.2: Average Monthly Crude Oil Spot Price: January 2000 to December 2014



Source: IMF

The crude oil price peaked at the end of June 2008 at around US$133.88 per barrel, but it plunged dramatically thereafter. Since the end of December 2014, the average crude oil prices of OPEC, US crude (West Texas Intermediate [WTI]), and British crude (Brent) reached 60.7, 62.34 and 59.29 respectively, compared to 102.1, 108.12 and 94.62 respectively at the end of December 2013. Figure 2.3 shows the movement of crude oil prices of OPEC, BRENT and WTI over the period January 2000 to December 2014.

Figure 2.3: Average Monthly Crude Oil Spot Price of OPEC, Brent and WTI: January 2000 to December 2014



Source: IMF

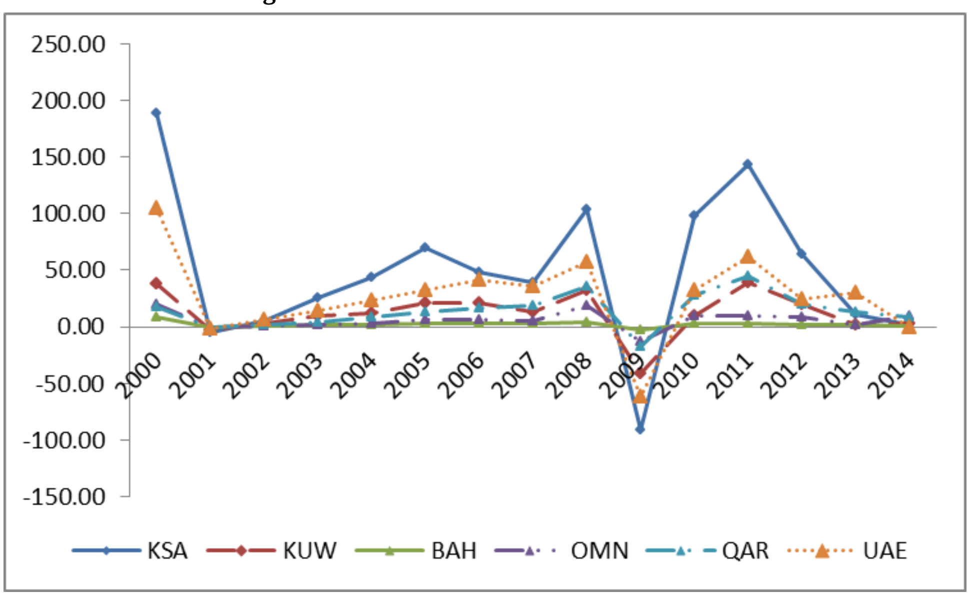
The GCC countries are still striving to develop their infrastructure and reform their economic sector by attracting foreign, domestic and regional private sector investments in gas, telecommunications, real estate, power generation, oil and other sectors. Recently, the recession and the drop in the global oil markets resulted in a slower pace of development and investment projects in the region, but the GCC countries have accumulated a huge fiscal surplus of US$287 billion, which will enable them to continue their projects in the next few years.

2.2 GCC Macroeconomic Overview

2.2.1 GDP Growth

The economies of GCC countries more than tripled in size from 2000 to 2014. As shown in Table 2.1 and Figure 2.4, during this period, real GDP grew in Saudi Arabia (by an average of 11 per cent), as well as Kuwait (14 per cent), Bahrain (12 per cent), Oman (13 per cent), Qatar (22 per cent) and the UAE (12 per cent). This strong economic performance was due to the robust global demand for crude oil until 2013, acceleration of economic reform, better geopolitical environment, power of the corporate sector, robust privatisation activities, and accelerated growth of assets of central and commercial banks. In real terms, the GCC economy grew by 4.4 per cent in 2014 compared to 4.0 per cent in 2013. Real GDP is forecast to grow and rebound by 3 per cent in 2015, except for Qatar, which is expected to grow and rebound by 5.3 per cent during the next few years as a result of increased expenditure and the role of international companies in organising the 2022 FIFA World Cup.

Figure 2.4: GCC Nominal GDP: 2000–2014



Source: IMF

Table 2.1: GCC GDP (US$ billion) and Percentage Growth: 2000–2014

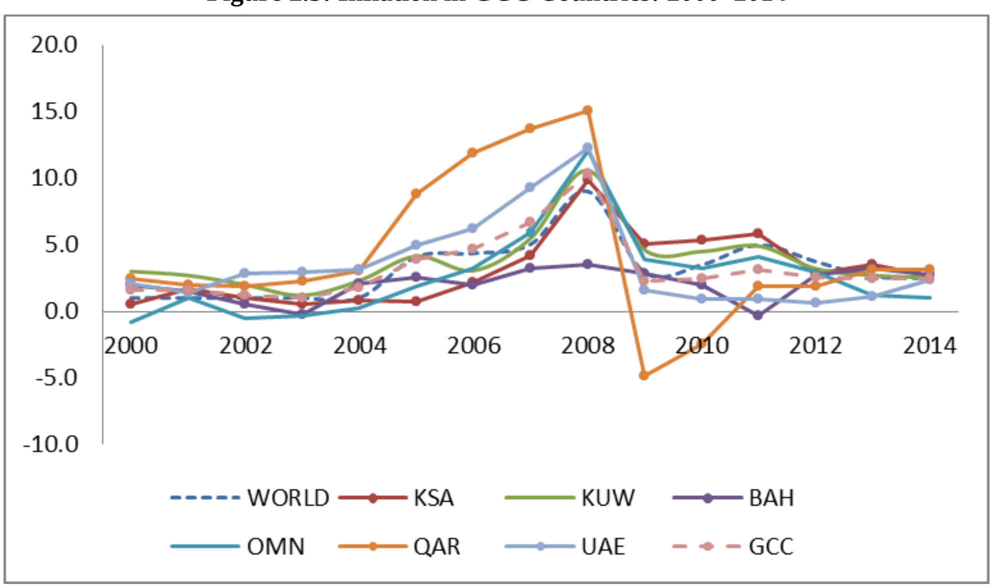
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
KSA	188.44	183.01	188.55	214.57	258.74	328.46	376.90	415.96	519.80	429.10	526.81	669.51	733.96	744.34	746.25
	0.17	-0.03	0.03	0.14	0.21	0.27	0.15	0.10	0.25	-0.17	0.23	0.27	0.10	0.01	0.00
KUW	37.72	34.89	38.14	47.88	59.44	80.80	101.56	114.64	147.38	105.91	115.42	154.03	174.04	175.83	179.26
	0.25	-0.07	0.09	0.26	0.24	0.36	0.26	0.13	0.29	-0.28	0.09	0.33	0.13	0.01	0.02
BAH	9.06	8.98	9.63	11.08	13.15	15.97	18.51	21.73	25.71	22.94	25.71	29.04	30.76	32.90	33.87
	0.37	-0.01	0.07	0.15	0.19	0.21	0.16	0.17	0.18	-0.11	0.12	0.13	0.06	0.07	0.03
OMN	19.51	19.45	20.14	21.63	24.76	31.08	37.22	42.09	60.91	48.39	58.64	67.94	76.34	78.18	87.97
	0.24	0.00	0.04	0.07	0.14	0.26	0.20	0.13	0.45	-0.21	0.21	0.16	0.12	0.02	0.13
QAR	17.76	17.54	19.36	23.53	31.73	44.53	60.88	79.71	115.27	97.80	125.12	169.80	189.94	203.24	211.82
	0.43	-0.01	0.10	0.22	0.35	0.40	0.37	0.31	0.45	-0.15	0.28	0.36	0.12	0.07	0.04
UAE	104.34	103.31	109.82	124.35	147.82	180.62	222.11	257.92	315.47	253.55	286.05	347.45	372.31	402.34	401.65
	0.24	-0.01	0.06	0.13	0.19	0.22	0.23	0.16	0.22	-0.20	0.13	0.21	0.07	0.08	-0.00

Source: IMF

2.2.2 Inflation

Figure 2.5 presents the average inflation rates in the GCC countries and shows that inflation remained subdued between 1.55 and 1.79 per cent from 2000 to 2004. In contrast, the GCC countries witnessed the highest average rate of inflation in 2008 (10.34 per cent) compared to 2006 (4.70 per cent) and 2007 (6.71 per cent). The higher inflation rate was attributed to the depreciation of the US dollar against other major currencies, such as the GBP, YEN and EURO, as well as supply/demand imbalances for services and goods (particularly construction material, food and beverages), lower interest rates, insufficient housing, ample liquidity and high spending. The average inflation rate in the GCC region declined dramatically to 2.42 per cent in 2014. This was attributed to the timely and wise policies of the GCC governments in view of slackening global demand for crude oil and unstable geopolitics.

Figure 2.5: Inflation in GCC Countries: 2000–2014

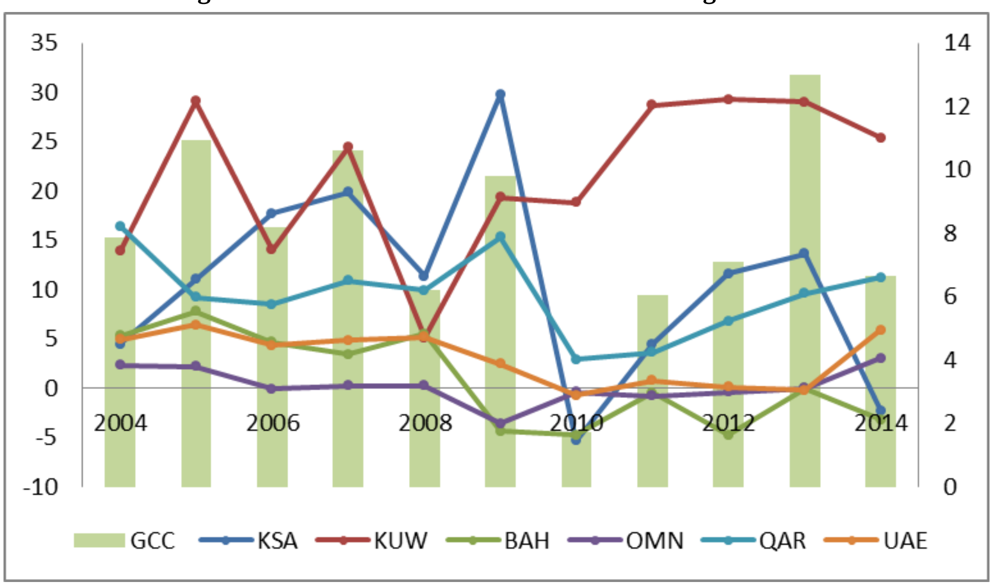


Source: IMF

2.2.3 Fiscal Position

Figure 2.6 shows that the GCC countries posted the highest surplus of 13 per cent of GDP in 2013 compared to 7.10 per cent in 2012 due to higher crude oil production levels and prices, as well as an increase in non-oil revenues. The large oil incomes earned by the GCC countries in the past resulted in strong capital spending. The budget surplus declined to 6.67 per cent of GDP in 2014 due to lower oil prices and an economic recession. The GCC countries are aware of the economic and fiscal reforms needed to reduce their dependence on the gas and oil sectors. The objective of economic diversification is in progress, notwithstanding regional threats and terrorism.

Figure 2.6: GCC Fiscal Balances as a Percentage of GDP

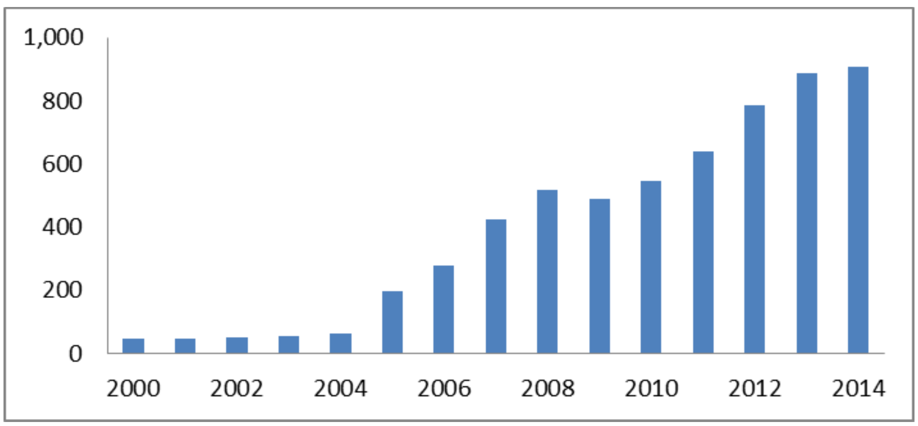


Source: IMF

2.2.4 Exchange Rates

All GCC countries peg their currencies to the US dollar except Kuwait which pegs to a basket of currencies. The GCC government's (represented by central banks) policy of reduced foreign credits (borrowing) has kept liabilities to a minimum and hence contributed more to the long-run stability of the regional currencies against the US dollar and, in the case of Kuwait, other major currencies. Strong demand for oil has resulted in further growth in foreign currency reserves, which has enabled the GCC countries to withstand pressure on the pegs. Figure 2.7 shows the total reserves minus gold of the GCC from 2000 to 2014. As shown, total reserves stood at US$907.56 billion at the end of December 2014 compared to US$885.75 billion at the end of December 2013.

Figure 2.7: GCC Foreign Reserves Minus Gold

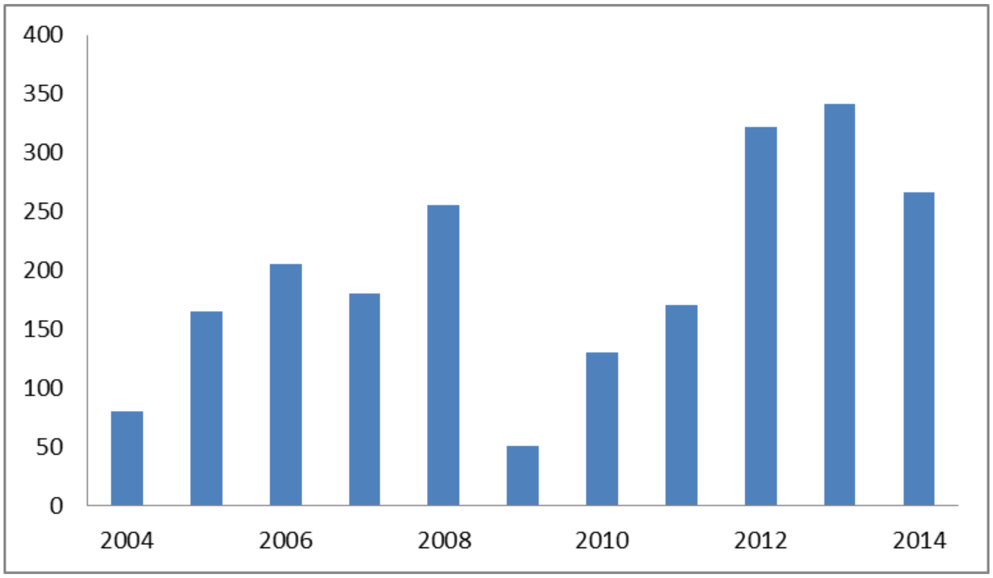


Source: IMF

2.2.5 External Accounts

The UAE enjoyed comparatively large surpluses on current accounts and foreign trade from 2005 to 2014 on the back of re-export earnings, high oil exports and non-oil exports. As a result of the decline in oil prices and the crises and wars in the region, the combined current account decreased from $322 billion in 2013 to $266 billion in 2014 (-17.40 per cent). Figure 2.8 shows the movement of the GCC current account from 2004 to 2014.

Figure 2.8: GCC Current Account



Source: IMF

2.3 Kuwait Stock Exchange Overview

2.3.1 History

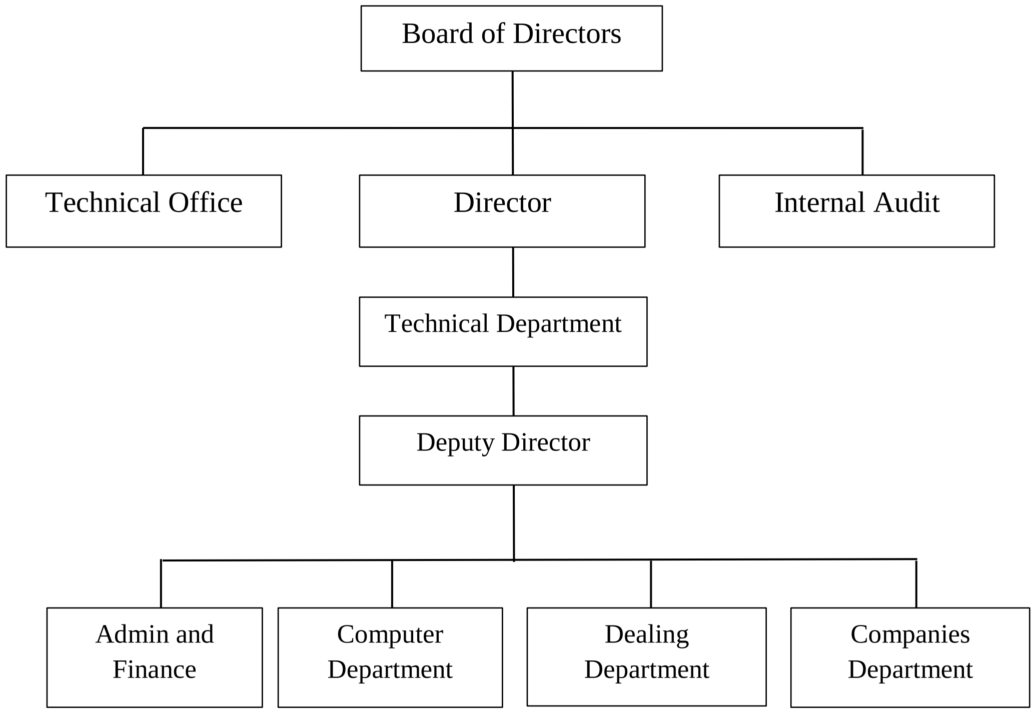
Although several shareholding companies (e.g., National Bank of Kuwait) operated in Kuwait before the Kuwait stock exchange was established, it was not until October 1962 (one year after independence in 1961) that a law was passed to establish the Kuwait stock market. The Kuwaiti government issued rules and laws to organise the trading of the securities market until 1983, when an Amiri Decree was issued to create the Kuwait Stock Exchange (KSE). The KSE was mandated to organise securities trading in the country. In February 2010, the Kuwaiti government created the 'Capital Markets Authority' through Law No. 7/2010, which was released by the Kuwait National Assembly. Kuwait was the first country to establish a stock exchange in the region. In November 1995, the KSE implemented its first electronic trading system.

At the end of 2009, the KSE signed an agreement with the NASDAQ to organise and implement the ‘SMARTS’ surveillance system and the ‘X-Stream’ trading system. This ‘partnership’ contract included provisions for the transfer of experience and knowledge, as well as training KSE staff on the new trading system. ‘SMARTS’ was implemented in May 2010, whereas the ‘X-stream’ trading system was implemented in May 2012. The KSE continued to develop trading systems through several initiatives and studies that focused on helping the stock market to comply with best practices and international standards. Based on this, the following stock market changes have taken place:

- The KSE eliminated the ‘Odd Lot’ Kuwait market, and the ‘Board Lot’ was withdrawn from the market.
- The KSE changed the policy of the closing price through the closing auction to the last traded price.
- The new auction system allows the use of time/price preference rather than the priority of the earliest transaction.
- The classification of companies into sectors is based on the international classification benchmark (ICB), which is a product of FTSE International Limited that the KSE licensed for use.
- The KSE established a new market index called ‘Kuwait 15’, which is designed to be more suitable for the range of new services and products in the Kuwait market.

2.3.2 Organisation Structure

Figure 2.9: Organisational Structure of the KSE



Source: Al-Abduljader (2004)

2.3.3 Trading System

2.3.3.1 Properties of the new trading system (X-Stream)

- ‘Odd Lot Market’ and ‘Board Lots’ were removed, and the minimum tradable unit is one share.
- The order size should not exceed 5,000,000 shares.
- Two KD is the minimum commission value in the Kuwait Stock Market, and the commission ratios are calculated as follows:
  - If the investor trades a total value of up to KD50,000, the commission rate is 0.125 per cent.

- If the investor trades a total value of more than KD50,000, the commission rate is 0.10 per cent.

- Transaction auctions are held at the close of trading with a pre-auction time period of two minutes where orders cannot be modified or cancelled.
- Transaction auctions use the common ‘time/price’ priority for consistency.
- The new system that specifies only five minutes’ waiting time for order cancellation/modification was removed.
- The new system introduces a new characteristic to increase the order quantity, whereas the old system depended on order priority.
- If there is action on the financial instruments, all pending orders are eliminated automatically upon closing.
- Forward market transactions are executed on the better price for the investor instead of being executed at the price determined by a broker.
- After removing the ‘quantity units’, the maximum and minimum quantity limits on forward transactions are as follows:
  - Minimum quantity of the forward trade is 5,000 shares.
  - Maximum quantity of the forward trade is 100,000 shares.

2.3.3.2 Trading Fees

The commission on transactions paid by investors is calculated as follows:

1. For transactions of less than KD50,000, the commission is KD1.25 for each one thousand KD.

2. For transactions of more than KD50,000, the commission is KD1 for each one thousand KD.

2.3.3.3 Kuwait 15 Index Structure

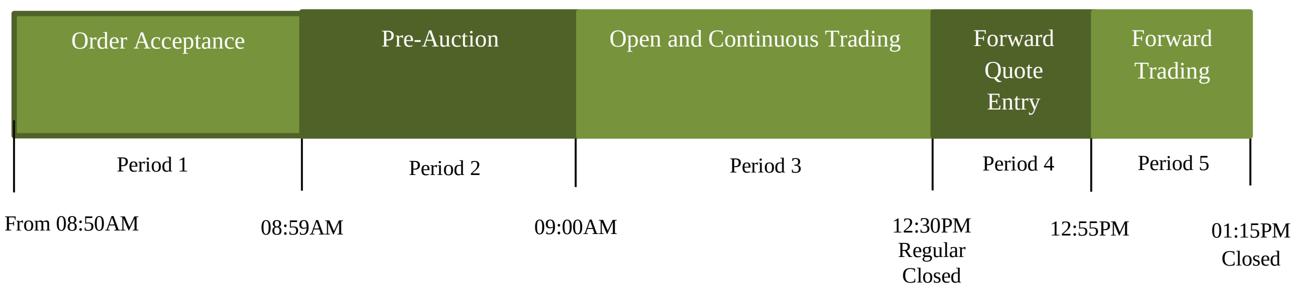
- The Kuwait 15 index is reviewed from period to period to cater for the demands of stock index stability, low transaction costs and investment ability, while maintaining a high correlation with the underlying stock market.
- The index is a market capitalisation weighted index.
- The index comprises the 15 top-ranked businesses according to size and liquidity.
- Its constituents are selected and reviewed semi-annually to reflect the most liquid and highest market capitalisation values in the stock market.
- The index can serve as the basis for index-related financial instruments, such as exchange traded funds (ETFs), index derivatives, structured products and indexed funds.
- The Kuwait 15 index is highly correlated with the KSE all stock market capitalisation index.
- The selection process of the Kuwait 15 index constituents is as follows:
  - The 50 most traded businesses by turnover according to measured liquidity are selected.
  - These businesses are then ranked by capitalisation.
  - The 15 highest-ranked businesses by capitalisation are designated to the Kuwait 15 index for the next period.

- At the time of the periodic review, the KSE publishes a reserve list of three to five ranked businesses.

2.3.4 Trading Mechanisms

The trading day is divided into five distinct periods, as shown below.

Figure 2.10: KSE Trading Mechanism



2.3.5 Market Structure

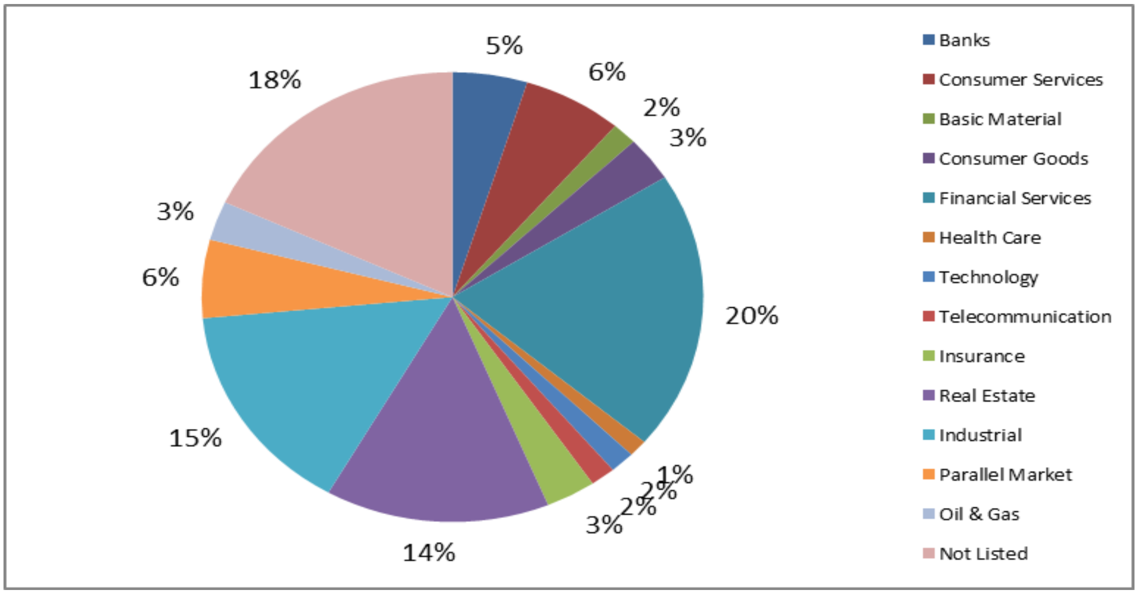
Based on the KSE classification, at the end of 2014, there were 249 listed companies (45 companies are not listed) divided into 15 sectors. This classification is shown in Table 2.2 and Figure 2.11.

Table 2.2: KSE Sector Classification at the End of 2014

Number	Sector Name	Sector code	Industry Name	Industry Code
1	Oil and Gas	0500	Oil and Gas	0001
2	Basic Materials	1000	Basic Materials	1000
3	Industrials	2000	Industrials	2000
4	Consumer Goods	3000	Consumer Goods	3000
5	Health Care	4000	Health Care	4000
6	Consumer Services	5000	Consumer Services	5000
7	Telecommunications	6000	Telecommunications	6000
8	Utilities	7000	Utilities	7000
9	Banks	8300	Banks	8000
10	Insurance	8500	Insurance	8000
11	Real Estate	8600	Real Estate	8000
12	Financial Services	8700	Financial Services	8000
13	Investments Instruments	8980	Investments Instruments	8000
14	Technology	9500	Technology	9000
15	Parallel	9900	Parallel	9000

Source: KSE

Figure 2.11: Total Companies Listed in Each Sector of the KSE at the End of 2014

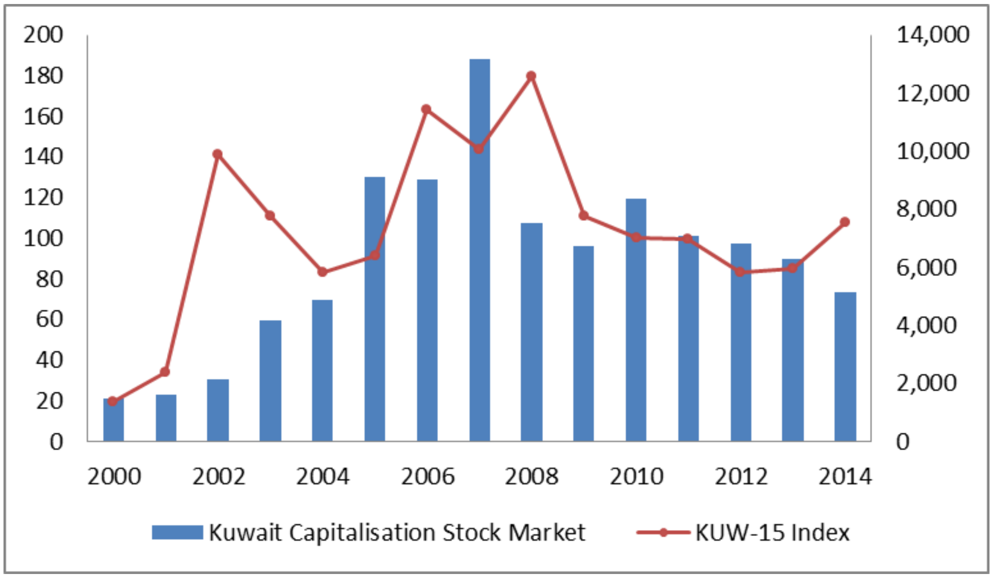


Source: KSE

2.3.6 Kuwait 15 Index and Market Capitalisation

Until the end of December 2014, the KSX-15 index declined 13.4 per cent, and the value-traded average reached US$83.9 billion, which was a decline of 44.7 per cent from the average value traded of US$151.96 billion in 2013. Market capitalisation declined 57.8 per cent, from US$1,731.5 billion in 2013 to US$731.6 in 2014. Figure 2.12 shows the KSX-15 index and market capitalisation from 2000 to 2014.

Figure 2.12: KSE Index and Capitalisation Market: 2000–2014



Source: Capitalisation data from IMF and Stock Price Index from the KSE

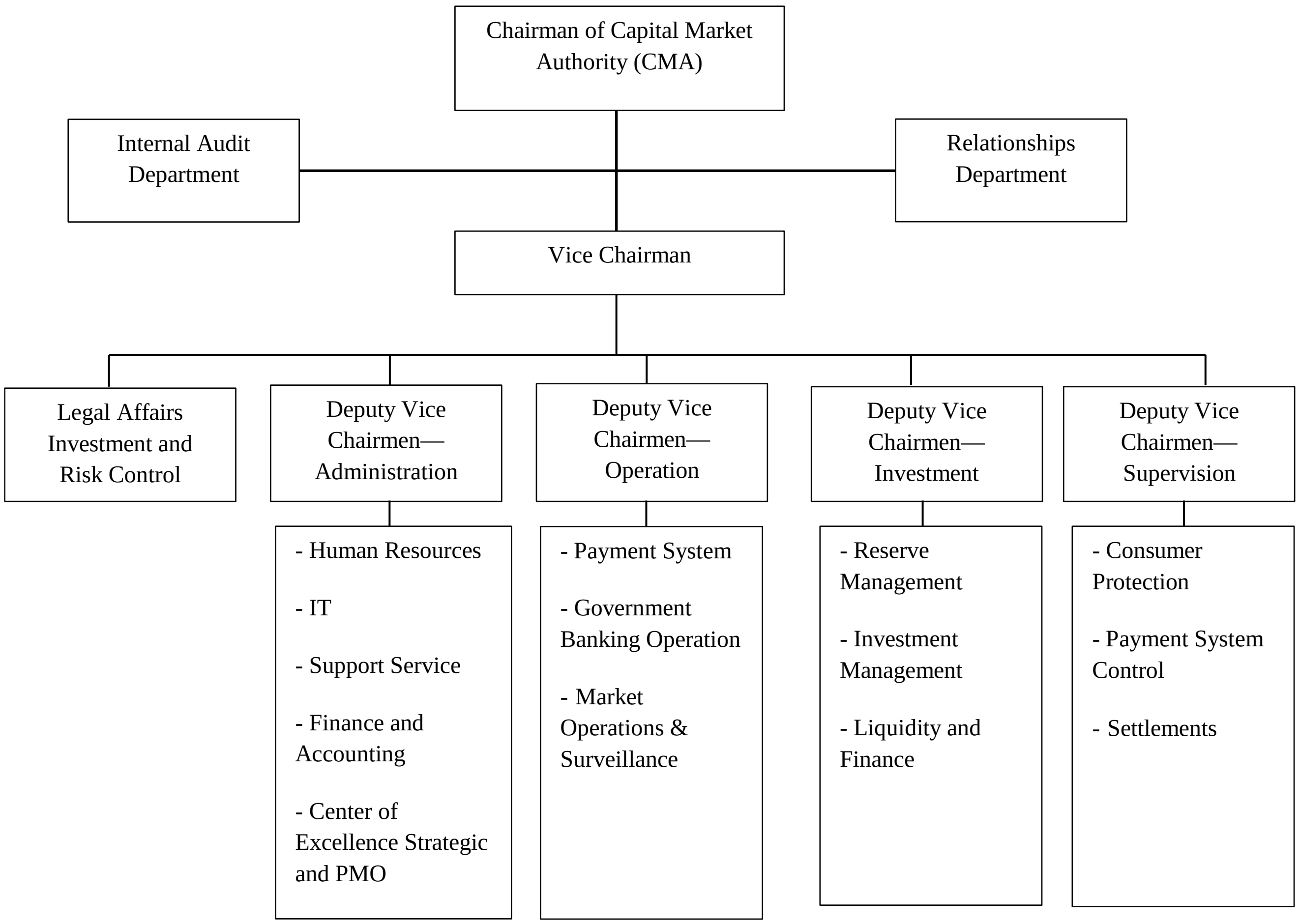
2.4 Saudi Stock Exchange Overview

2.4.1 History

The Saudi Stock Exchange (SSE or Tadawul) was created in 1984 by a ministerial committee that was formed to regulate and develop the stock market. In 2003, the SSE established the Saudi Capital Markets Authority (CMA). The Saudi markets continued to grow rapidly until the global financial crisis in 2007–2008. The SSE was converted from a mutually owned organisation into a joint-stock company in 2007, when an electronic trading system, OMX, was put in place. During the turmoil of 2007–2008, the Saudi CMA moved to support and shore up stock trading on the SSE by taking several steps to encourage and attract more foreign investments into Saudi Securities Markets (SSM). In mid-2015, the SSE was opened to foreign investors for the first time. This step allowed approved foreign investors from outside the GCC to directly invest in and own Saudi stocks without a third party.

2.4.2 Organisation Structure

Figure 2.13: Organisational Structure of the SSE



Source: Aladwani (2015)

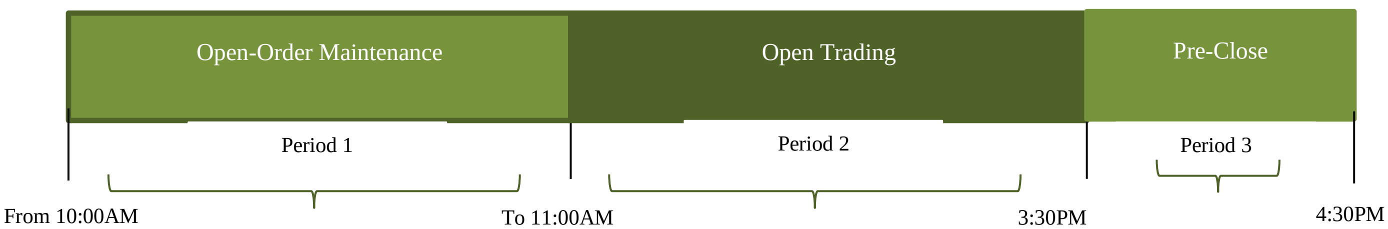
2.4.3 Trading System

In 1990, the SSE implemented the first electronic share trading system under the name ESIS, and this was replaced in mid 2001 by a more developed trading system. The new system, which introduced new order/transaction types, was capable of handling larger trading volumes in short periods. The trading system has since undergone a series of enhancements and expansions to enable it to execute more than 800,000 transactions daily. The SSE (or Tadawul) signed a partnership agreement with OMX, a leading operator and supplier of stock exchange technology, for the design, implementation and supply of trading, settlement and depository systems, as well as information dissemination and surveillance. The new, advanced infrastructure supports the SSE's plans to extend its business and product offerings. The advisory investment firms are linked directly with the Tadawul system, where they can amend and enter buy-and-sell orders, and obtain news and online market information.

2.4.4 Trading Mechanisms

The trading day is divided into three distinct periods, as shown below.

Figure 2.14: SSE Trading Mechanism



In period 1, a number of orders can be entered, amended or cancelled. The five high price levels are displayed for each symbol, along with the total number of transactions/orders in each level and the total and average trading volumes. At the beginning of period 2, opening prices are determined and continuous trading commences. The five high price levels are displayed for each symbol, along with the total number of orders in each level and the total volumes. The best 10 orders by price are also displayed. Orders can be entered, amend or cancelled. In period 3, the five best price levels are displayed for each symbol, along with the total number of orders in each level and the total volumes. The best 10 orders by price are also displayed. Orders can be cancelled and order validity amended. Order entry and changes in order price or volume are not allowed in this session. Further, new orders cannot be accepted.

2.4.5 Conditions and Order Types

In period 1, investors have limit orders to enter without any conditions. If not implemented at the opening, they will be transferred to continuous trading. If entered with the condition to execute at the opening, they will be removed if not implemented or partially implemented at the opening. In period 2, certain situations can be applied to limit orders. If ‘fill-and-kill’ (FAK) is not implemented fully or partially, the whole or the remaining volume is removed automatically. Under ‘fill-or-kill’ (FOK), the full volume quantity has to be implemented or cancelled; partial implementation is not allowed.

For unpriced transactions/orders (or market transactions/orders), the transaction/order is implemented at the available market prices. Price protection within five price ticks is put on in both sides during the continuous trading. Price protection is not executed to market orders entered during the pre-opening period.

Additional conditions can be applied to market orders. In period 1, a call-only condition can be added. If the order is not carried out or partially implemented at opening time, the remaining trading quantity will be removed automatically. During continuous trading, market transactions/orders are removed/cancelled if there is no opposite market. An undisclosed transaction/order has a limit order that is usually a very large volume. Only the disclosed volume is shown to the stock market. The total volume must not exceed

4,000 times the disclosed volume, and vice versa. In period 1, the whole volume is included in the market by the price level. In period 2, when the disclosed volume is executed, a new volume is shown with a new priority.

2.4.6 Market Structure

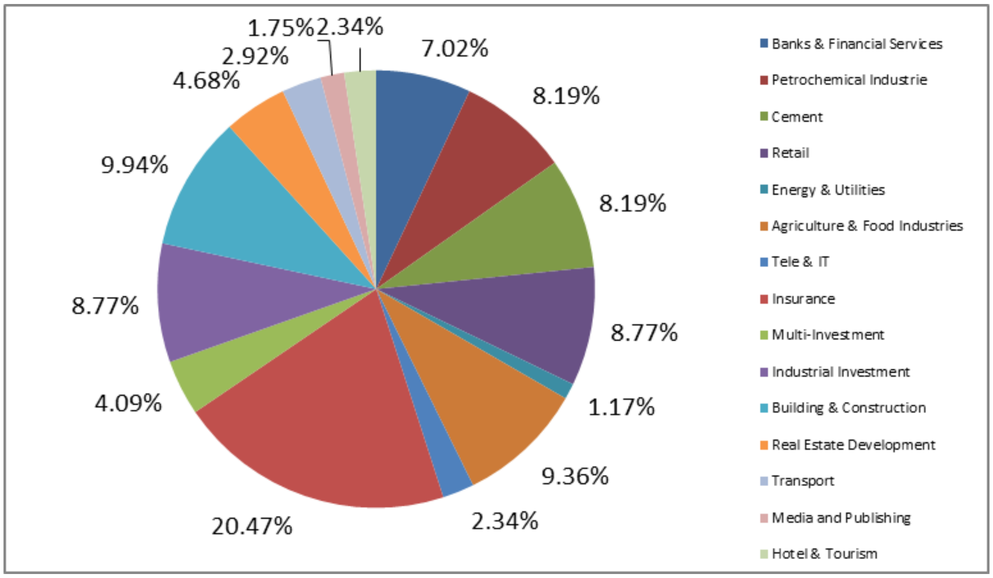
At the end of 2014, the SSE listed 171 companies divided into 15 sectors based on the Bloomberg classification (see Table 2.3 and Figure 2.15). Each sector has its own sub-index.

Table 2.3: SSE Sector Classification at the End of 2014

	Sectors	Total Companies
1	Banks & Financial Services	12
2	Petrochemical Industries	14
3	Cement	14
4	Retail	15
5	Energy & Utilities	2
6	Agriculture & Food Industries	16
7	Telecommunication & Information Technology	4
8	Insurance	35
9	Multi-Investment	7
10	Industrial Investment	15
11	Building & Construction	17
12	Real Estate Development	8
13	Transport	5
14	Media and Publishing	3
15	Hotel & Tourism	4

Source: SSE

Figure 2.15: Total Companies Listed in Each Sector of the SSE at the End of 2014

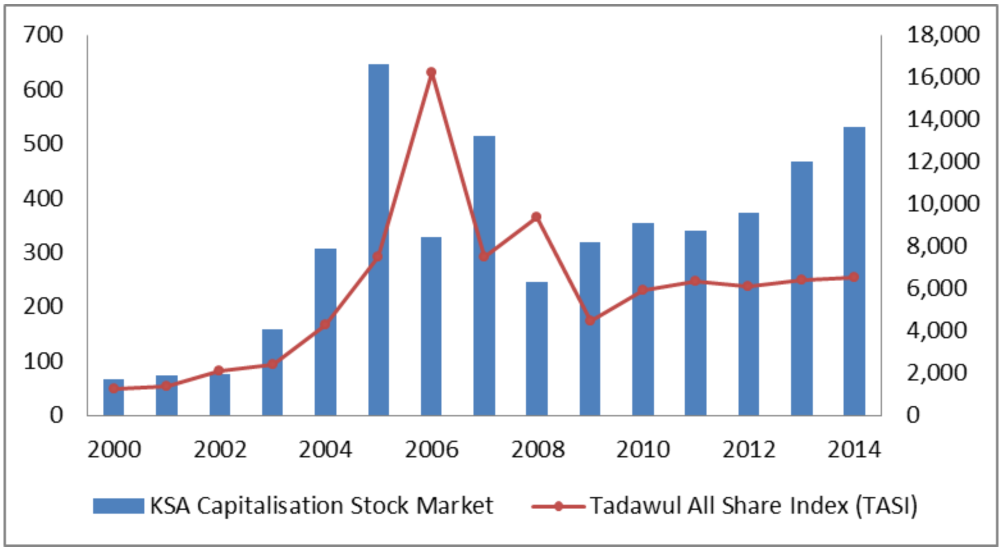


Source: SSE

2.4.7 Index and Capitalisation History

Figure 2.16 outlines the changes in the SSE index and market capitalisation from 2000 to 2014. The SSE index is considered one of the best performing of all indices in the GCC. Market capitalisation increased 22.17 per cent in 2013 to US$467.37 billion at the end of 2014. Basic materials and finance were the dominant sectors, accounting for 71 per cent of total market capitalisation. The petrochemicals producer (Sabic) and Al Rajhi Bank were the two largest companies, each commanding approximately 11- 12 per cent of the total market. A number of small sectors in the SSE have a large number of listed companies, such as the consumer goods sector (17 listed companies), although these companies form only 4–5 per cent of the total market value.

Figure 2.16: Tadawul All Share Index (TAS) and Market Capitalisation: 2000–2014



Source: Capitalisation data from IMF and Stock Price Index from SSE (Tadawull)

2.5 Bahrain Bourse Overview

2.5.1 History

The Bahrain Stock Exchange (BSE) was established in 1987 based on an Amiri Decree. Over time, the Bahrain government issued a number of rules and regulations to organise the BSE. These culminated in 2010, when changes were made to the structure of the BSE to enable it to become a shareholding company according to Law No. 60. As a result, the official name was changed to Bahrain Bourse (BHB).

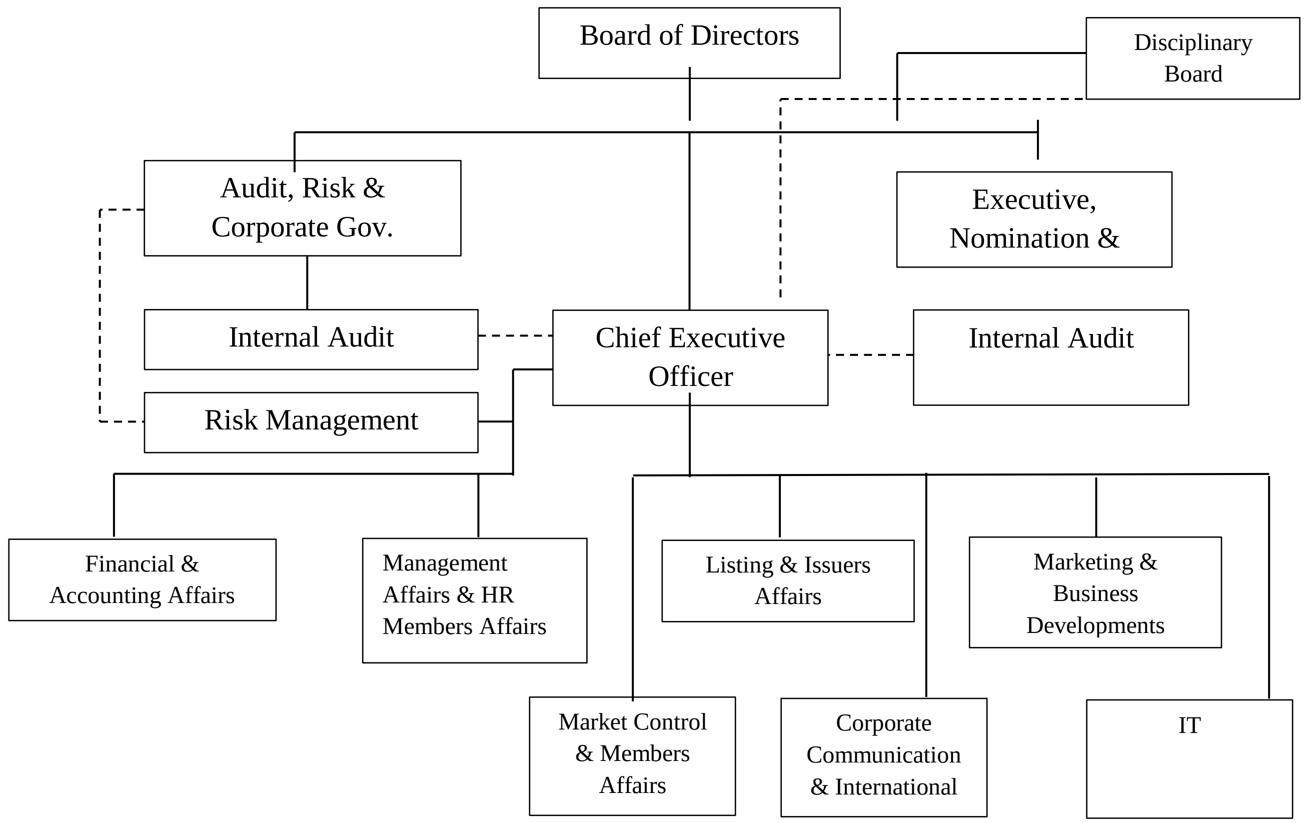
Bahraini investors were introduced to trading in stocks with the creation of the First Telecommunications Group (FTG) with Batelco in 1957 as the first Bahraini shareholding company. From 1957 to 1980, several shareholding companies were established. Throughout this period, the shares of these companies were traded in the Al-Jawhara Market, which was a non-official market. This market collapsed in the 1980s—

around the same time as that of the Souk Al-Manakh in Kuwait. Following the collapse of the unofficial market, the government of Bahrain collaborated with the International Finance Corporation (IFC) to conduct a feasibility study to create the first official market in the country. As a result of the feasibility study's recommendation, the BSE was established at the beginning of 1987 under Amiri Decree No. 4. Since then, the trading of shares has been conducted by hand through the traditional auctional trading system. In mid-1999, an automated trading system (ATS) was adopted to execute trading orders electronically.

At the beginning of 2002, the regulatory authority and supervision of BHB was transferred from the Commerce Ministry to the Central Bank of Bahrain (CBB). With the prosperity and development of the BHB, the Bahrain government and most companies began issuing a number of financial instruments, such as bonds and other securities, to take advantage of the technical and legislative infrastructure created by the BHB. Since then, the BHB has witnessed the registration and listing of bonds, mutual funds and preferred shares, making it the first GCC market to list these financial instruments. In February 2010, the BHB moved to the Financial Harbour. The BHB has joined a number of international and regional organisations, including the World Federation of Exchanges, the Association of National Numbering Agencies, the Federation of Euro-Asian Stock Exchanges, the Union of Arab Stock Exchanges, and the Africa & Middle East Depositories Association to stay up-to-date on administrative, legislative and technical developments in foreign capital markets.

2.5.2 Organisation Structure

Figure 2.17: Organisational Structure of the BHB



Source: BHB

2.5.3 Trading System

The first trading system (the ATS) was installed in 1990 to execute transactions/orders. The ATS has many benefits, such as listing various instruments, fairness in implementing transactions, greater flexibility to operate several markets at the same time, and speed and accuracy. The mechanism of the ATS can be controlled based on the regulations and rules of the BHB.

Before 1990, the trading system in BHD was the manual 'written bidding' system, whereby brokers had to write the offer and bid transactions/orders obtained from investors on the trading white boards in the trading hall. Since 1999, three markets have been supported by the ATS. The first is the stock market, comprising a regular market, initial public offerings (IPOs) and the special orders market (SOM) with a minimum value of BHD500,000. The second is the bonds market, which specialises in trading Islamic bonds (*sukuk*) and regular bonds. The third is the mutual funds markets, which specialises in trading domestic mutual funds.

2.5.4 Trading Mechanisms

The trading day is divided into two distinct periods, as shown below.

Figure 2.18: BHB Trading Mechanisms

In period 1, the advisory investments through the brokers register the bids and offers they obtain from different investors into the ATS. The mechanisms that determine the prices of equities are as follows:

1. The price priority (best price): The transaction/order is implemented for the best (highest) price.

2. Type of orders: When an order is conditional, precedence of implementation is given to transactions/orders that are unconditional. For instance, if there are two or more orders with equal prices, the ATS gives precedence to the unconditional order.
3. Time of order priority: If the type and price are similar, precedence of execution is given to the orders entered into the first order in ATS.
4. Cross-priority: This type is executed if the one with the priority is on the active side. Trading in cross-priority takes precedence over others.
5. Random factor priority: If two orders are received at the same time, precedence is given to the random factor.

In period 2, if there are any fluctuations in prices, the ATS is fixed to a maximum of 10 per cent either way from the last closing. For example, if the closing price was BHD1 a day earlier, the minimum price it can reach the following day is BHD900 and the maximum is BHD1,100.

2.5.5 Market Structure

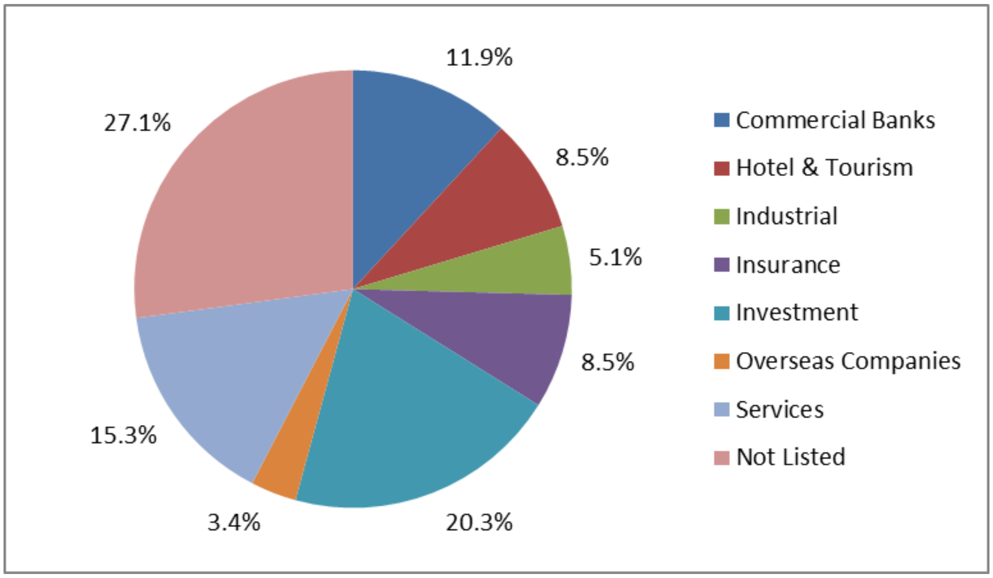
At the end of 2014, the BHB listed 58 companies divided into eight sectors based on the BHB classification (see Table 2.4 and Figure 2.19). Each sector has its own sub-index.

Table 2.4: BHB Sector Classification at the End of 2014

	Sectors	Total Companies
1	Commercial Banks	7
2	Hotel & Tourism	5
3	Industrial	3
4	Insurance	5
5	Investment	12
6	Overseas Companies	2
7	Services	9
8	Not Listed	16

Source: BHB 2014 report

Figure 2.19: Total Companies Listed in Each Sector of the BHB at the End of 2014

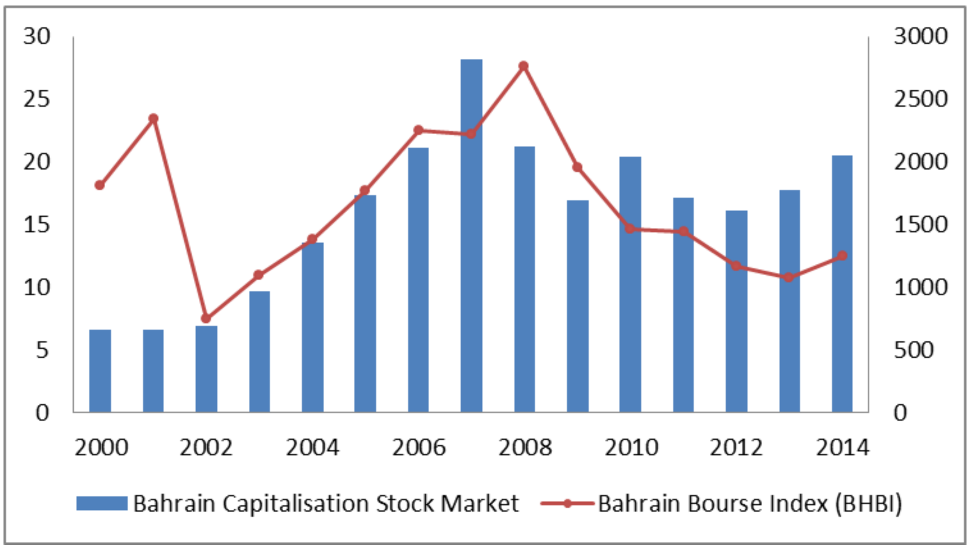


Source: BHB

2.5.6 Index and Capitalisation History

Figure 2.20 shows the changes in the BHB index and market capitalisation from 2000 to 2014. The BHB index is more volatile than comparable indexes in other GCC countries. At the end of December 2014, the BHB index was up by 10.05 per cent compared with 2013. At the end of December 2014, it stood at US$20.46 billion, which was an all-time high. According to Bloomberg, telecommunication and banks are the dominant sectors, accounting for 65 per cent of total market capitalisation. The Al-Salam Bank, Khaleeji Commercial Bank and Bahrain Telecommunication Company are the largest three companies in terms of market share. A number of small sectors encompass a large number of listed companies—for example, 26 listed companies belong to the investment, services and insurance sectors, but they comprise no more than 3 per cent of the total market value.

Figure 2.20: BHB Index and Market Capitalisation



Source: Capitalisation data from IMF and Stock Price Index from BHB

2.6 Muscat Securities Market Overview

2.6.1 History

In June 1988, the Muscat Securities Market (MSM) was created based on Royal Decree No. 53 to control and organise market participation. Based on Royal Decree No. 80, two separate entities were established pertaining to the new capital market law: the CMA, whose main task is control and regulation, and the stock exchange, where all listed financial instruments are traded. The objective was to enhance investors' confidence by improving operations. Rules and regulations were put in place to directly present financial data and information on the performance of the stock market and all listed companies to domestic and foreign investors through the new electronic trading system. The new system was designed to ensure the transparency of trading and related activities. One objective was to attract domestic regional and foreign investors to the Oman market.

The MSM developed its settlement and clearance processes by introducing a new technique to encourage regular and steady dealing in financial instruments, and to present the best business environment to help attract foreign capital to Oman. The previous settlement process involved three participants in the process: the broker, the Muscat Clearing and Depository Company. The settlement formula was introduced through the Settlement Guarantee Fund (SGF) and the Settlement Bank (SB). The SGF was created from the contribution of all investment companies and brokers operating in the Oman stock market. The main objective of the SGF is to provide a guarantee of settlement among brokers. If a broker is unable to settle, the SGF will convey the deficit to the SB on behalf of the brokers, and hence gather the amounts from the brokers. The settlement process can then be completed smoothly.

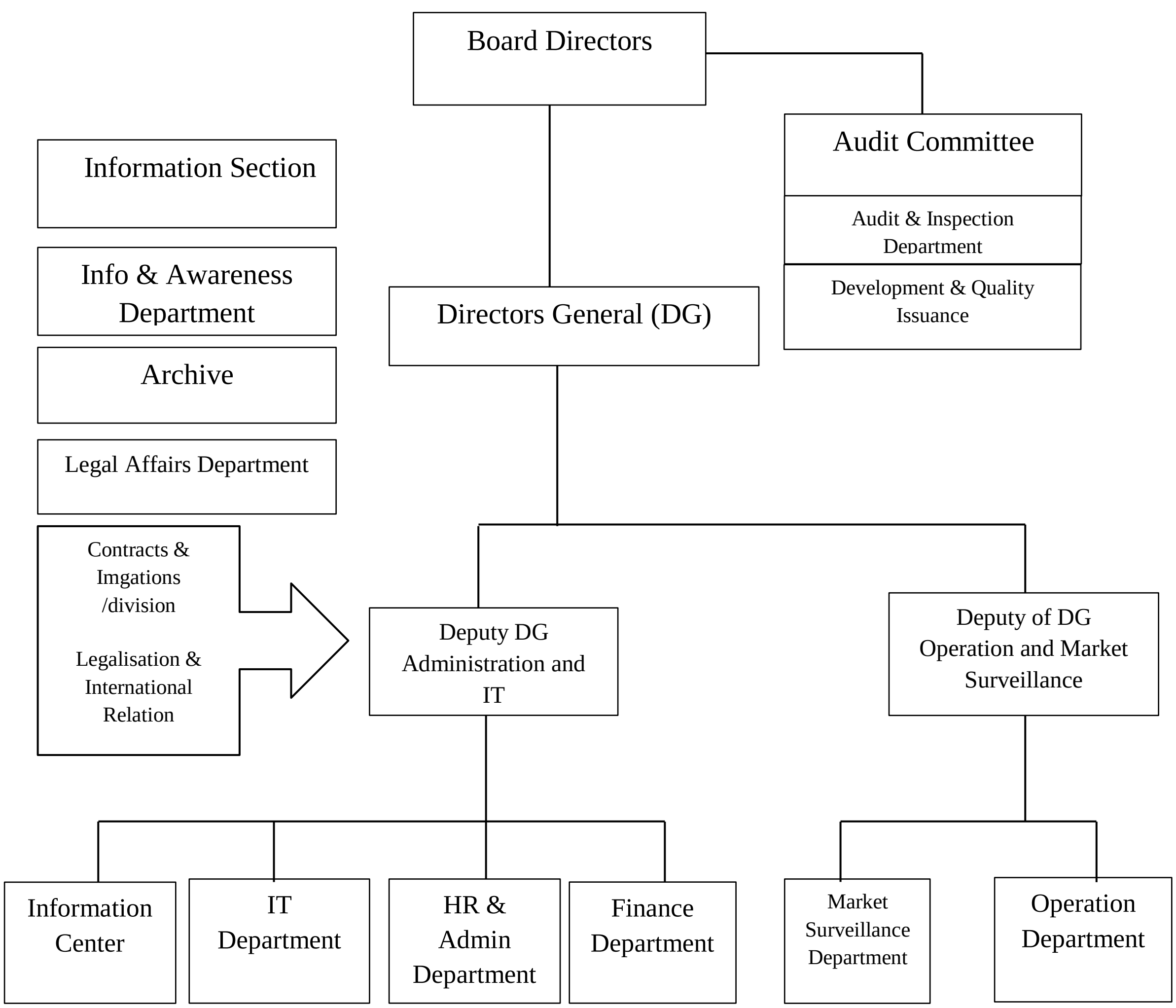
The business aims of the MSM are as follows:

- To support and encourage investment in financial instruments for the benefit of the national economy.

- To protect foreign and domestic investors from unsound and unfair practices by improving and enhancing transparency and disclosure.
- To accelerate and facilitate the procedure of liquidating the funds invested in financial instruments, and to ensure the interaction of demand and supply.
- To enhance awareness of the opportunities of investing in financial instruments.
- To submit proposals and studies on regulations and laws to the CMA.
- To interact with financial markets abroad to exchange expertise and information.
- To create rules of self-regulation and discipline for investment advisory firms.

2.6.2 Organisation Structure

Figure 2.21: Organisational Structure of the MSM



Source: MSM

2.6.3 Trading System

In 1993, the MSM implemented automation to create a central depository followed by settlement, trading and clearing systems in 1998. All of these systems were provided by Andersons Technologies and Consultancy. In 2006, the MSM started to use a more advanced trading system under the name (NSC with V800) provided by Atos Euronext. At the beginning of 2012, the MSM adopted a new version of the trading system under the name (NSX with V900) provided by the NYSE–Euronext company.

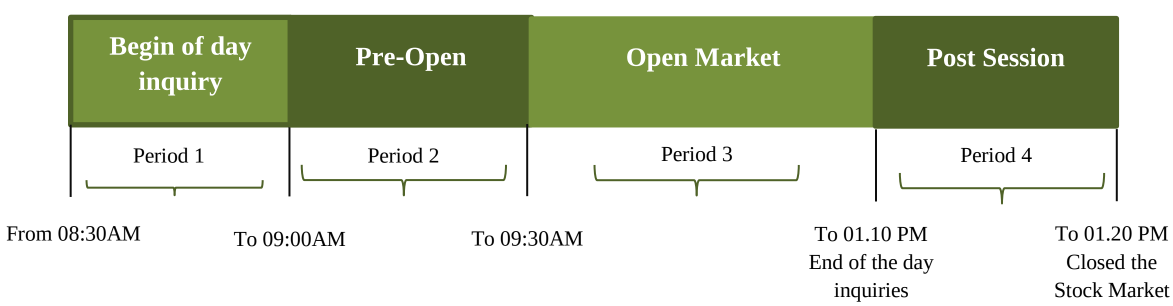
The NSX trading system has several characteristics. Access to the stock market by participants is organised by three levels of control. Level 1 is managed by the stock market, which has control over access to the markets as well as transactions, orders and management. This permits the MSM to disable/limit any unauthorised access to the NSX trading system at any time. Level 2 is an application known as professional accesses to the stock market administration (PAMAdmin), which the exchange provides to advisory investment companies to allow the head of brokerage in these firms to set a profile for each dealer/trader. By doing so, a dealer is limited to the bounds set in his or her profile, such as trading markets/days, trader cap and username with password. The MSM maintains overall supervision of PAMAdmin and can disable a user's access at any time. This well-administered access gives MSM full control, while allowing companies to set risk bounds for each trader. In Level 3, control is defined by the dealers, where they use their advanced workstation (PAMAdmin) to place restrictions on values, volumes, instrument states, pre-conformation and price fluctuation limits, and other functions.

The NSX trading system supports different order types, such as limit, open price, market to limit, market order and stop limit. The types of orders include FAK, GTC, sliding (up to 30 days) and GTD. For priority orders, the MSM follows the first in, first out (FIFO) model. There are four types of quantity: (i) total quantity to be implemented; (ii) disclosed quantity, which is the quantity that the investor needs to disclose orders on the stock market to other investors; (iii) minimum quantity, which the investor needs to trade on the stock market; and (iv) displayed quantity, which is the actual amount of a transaction/order that is shown to the stock market at any point of time. The tick size is unified at 0.001 for all financial instruments listed on the MSM. Block trades are allowed when a dealer wishes to meet definite criteria before it can qualify as a trade block.

2.6.4 Trading Mechanisms

A trading day is divided into four distinct periods, as shown below.

Figure 2.22: MSM Trading Mechanism



2.6.5 Market Structure

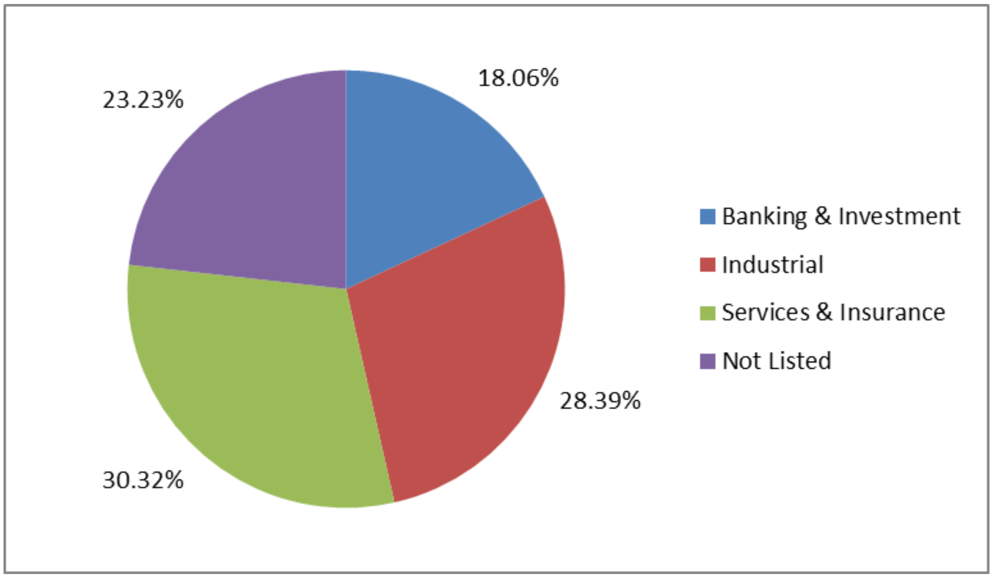
At the end of 2014, the MSM listed 155 companies divided into four sectors based on the MSM classification (see Table 2.5 and Figure 2.23). Each sector has its own sub-index.

Table 2.5: MSM Sector Classification at the End of 2014

	Sectors	Total Companies
1	Banking & Investment	28
2	Industrial	44
3	Services & Insurance	47
4	Not Listed	36

Source: MSM

Figure 2.23: Total companies listed in Each Sector of the MSM at the End of 2014

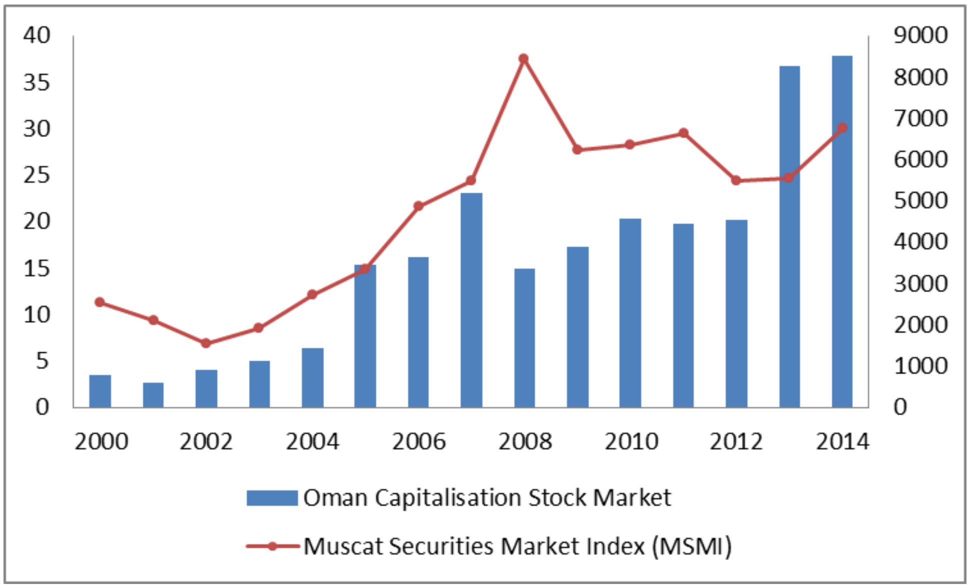


Source: MSM

2.6.6 Index and Market Capitalisation

Figure 2.24 shows the changes in the MSM index and market capitalisation from 2000 to 2014. By the end of December 2014, the MSM index had declined 13.9 per cent compared with 2013. Market capitalisation increased 82.85 per cent in 2013 to US$36.77 billion. At the end of December 2014, it stood at US$37.79 billion, which was an all-time high. According to Bloomberg, banking and investment is the dominant sector, accounting for 59 per cent of total market capitalisation. The Ahli Bank, Bank Dhofar, Al-Batinah Development & Investment Holding and Bank Muscat are the four largest companies in terms of market share. A number of small sectors in the MSM have a large number of listed companies—for example, the services and insurance sector contains 47 listed companies, but these companies account for only 8 per cent of the total market value.

Figure 2.24: MSM Index and Market Capitalisation



Source: Capitalisation data from IMF and Stock Price Index from MSM

2.7 Qatar Stock Exchange Overview

2.7.1 History

The Doha Securities Market (DSM) was established in 1995 and started operations in 1997. Since then, it has rapidly grown to become one of the leading stock exchanges in the Middle East. In mid-2009, Qatar Holding, which is the strategic and direct investment arm of the Qatar Investment Authority (QIA), signed a partnership agreement with NYSE–Euronext, which is one of the world's leading exchange groups. The DSM was renamed the Qatar Stock Exchange (QSE) as part of the deal, with the objective of providing foreign and domestic investors and all market participants with important market information. Another objective was to establish Qatar as a regional financial centre.

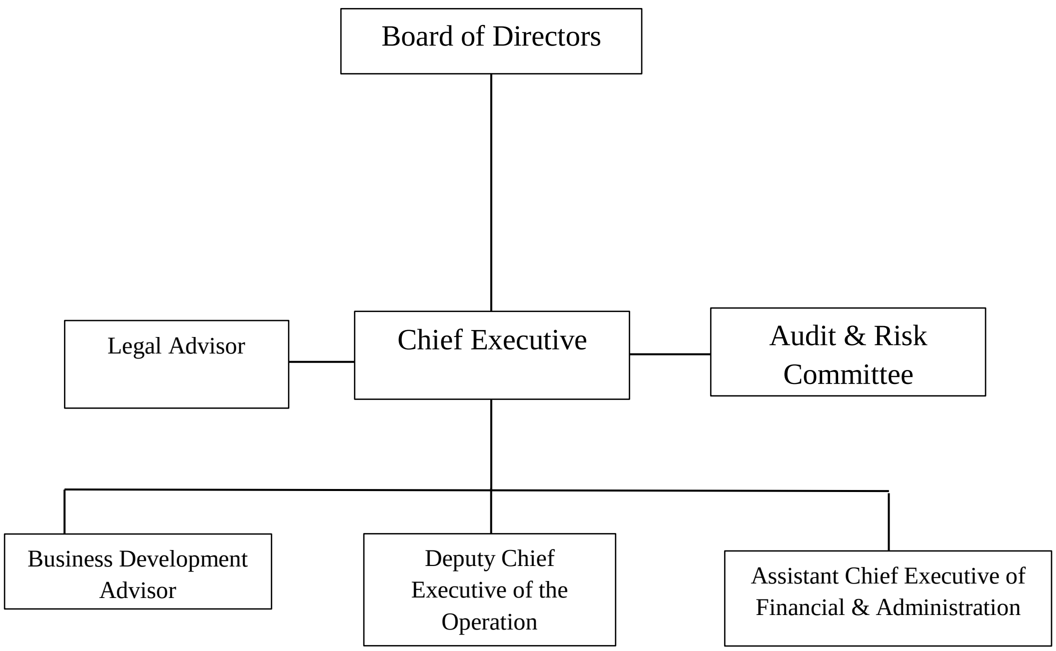
Major developments include the following:

- In 1997, trading started.
- In 1998, a central registration system was introduced.
- In 1999, all investors were able to sell their own shares on the day following the purchasing day (T+1).
- A linkage project through the Internet for Qatari companies was introduced in March 2000.
- Online trading started in 2001, following the replacement of the old trading system.
- In 2002, many changes took place, including: (i) approval of a new market index to reflect changes in listed companies; (ii) launching of the website; and (iii) approval of a new market index to reflect changes in listed companies.
- In 2003, the QSE moved to its new premises after preparing the new building with the latest technological equipment.
- In 2005, the QSE was opened to foreign investors to invest up to 25 per cent from the total shares offered for trading.
- In 2005, there was a merger between the irregular and regular markets.
- The QSE became a member of the World Federation of Exchanges (WFE) in 2007.

- In 2009, a strategic partnership agreement was signed between Qatar Holding and NYSE–Euronext.

2.7.2 Organisation Structure

Figure 2.25: Organisational Structure of the QSE

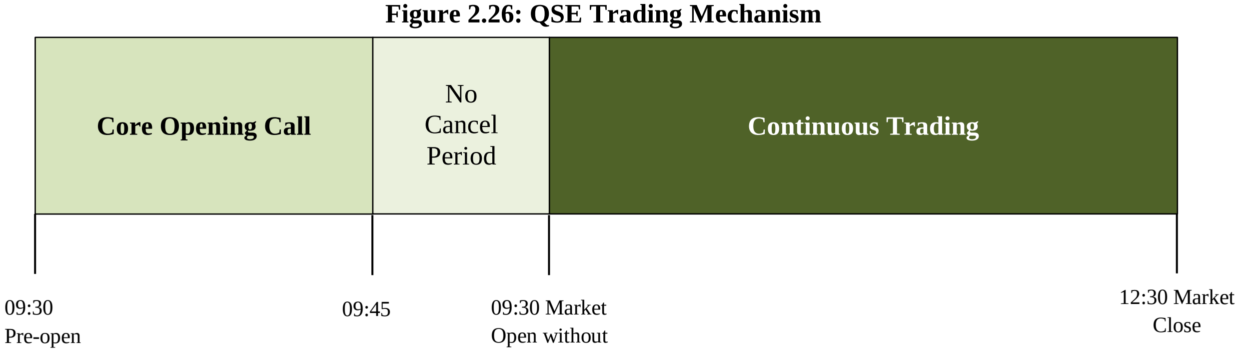


Source: Aladwani (2015)

2.7.3 Trading Mechanisms

Current Trading Timetable

Figure 2.26: QSE Trading Mechanism



TP Trading Mechanisms

Figure 2.27: QSE TP-Trading Mechanism

Source: DSE

2.7.4 Trading Systems

The continuous trading phase includes opening/closing auctions. The call phase is valid for both opening and closing calls involving: (i) entering, modifying or cancelling orders; (ii) no matching; and (iii) calculation of indicative matching prices. In the auction phase, orders are matched according to the auction algorithm, and the closing auction determines the closing price. The closing auction is followed by a Trading-at-Last (TAL) phase. Automatic matching is carried out during the continuous phase. Orders can be classified into the following:

- A limit order is an order to sell or buy at a particular price or the best price. The order is implemented for the entire quantity until the limit price is reached. If there is any residual quantity once the limit price is reached, the order stays in the book at this price.
- A market order is an order that is entered without a price limit that will trade against opposite orders until the total quantity of the order has been reached (in the 10 per cent limit daily price).

- A market-to-limit order is an order to sell or buy a stated amount for immediate implementation at the best opposite price. A partly filled market-to-limit order becomes a limit order at the price it is implemented at.
- A stop-loss order is an order to sell or buy when an activated price is exceeded or reached. The activated price of a stop-loss order should be less (for a sell order) or greater (for a buy order) than the previous traded price. When activated, it behaves like a market order.
- A stop-limit order is an order to sell or buy if an activated price is exceeded or reached. The stop-limit order also has a limit price beyond which it cannot trade. The activated price of a stop-limit order should be less (for a sell order) or greater (for a buy order) than the previous traded price. If activated, it behaves like a market-to-limit order.

2.7.5 Market Structure

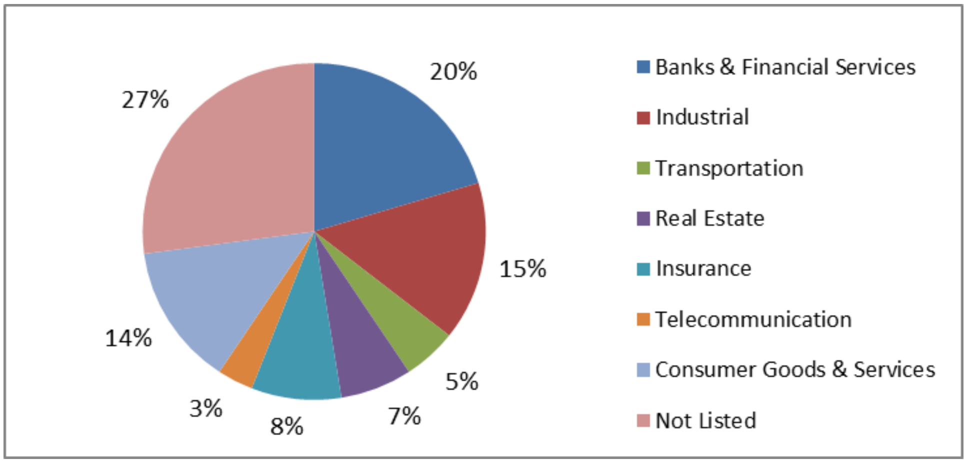
At the end of 2014, 59 companies were listed on the QSE, divided into eight sectors based on the QSE classification (see Table 2.6 and Figure 2.28). Each sector has its own sub-index.

Table 2.6: QSE Sector Classification at the End of 2014

	Sectors	Total Companies
1	Banks & Financial Services	12
2	Industrial	9
3	Transportation	3
4	Real Estate	4
5	Insurance	5
6	Telecommunication	2
7	Consumer Goods & Services	8
8	Not Listed	16

Source: QSE

Figure 2.28: Total Companies Listed in Each Sector of the QSE at the End of 2014

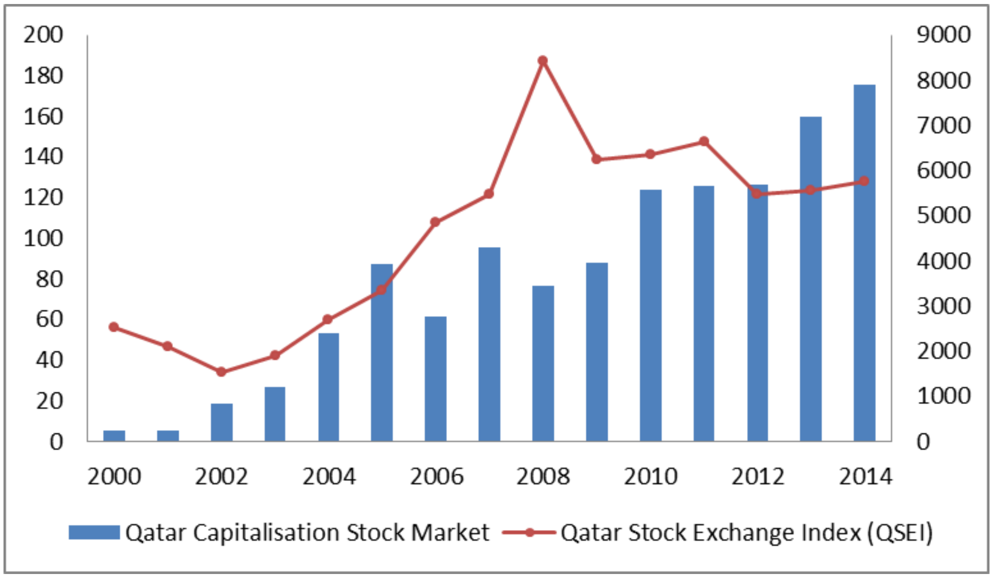


Source: QSE

2.7.6 Index and Market Capitalisation

Figure 2.29 shows the changes in the QSE index and market capitalisation from 2000 to 2014. By December 2014, the QSE index had dramatically increased by 53.5 per cent compared with 2013. Market capitalisation increased 26.43 per cent in 2013. At the end of December 2013, it stood at US$126.37 billion, and by December 2014, it was US$175.49 billion, which was an just the highest of the past 10 yea. Banks and financial services, industrial, and telecommunication are the dominant sectors in the stock market, accounting for 59.5 per cent of total market capitalisation. The Qatar National Bank, Qatar Islamic Bank, Doha Bank, Masraf Al Rayan, Industries Qatar and Mesaieed Petrochemical Holding Co. are the six largest companies in terms of market share, commanding approximately 69 per cent of the total market. Some small sectors have a large number of listed companies—for example, the consumer goods and services, real estate, and transportation sectors comprise 12 listed companies, but they account for only 6.0 per cent of the total market value.

Figure 2.29: QSE Index and Market Capitalisation



Source: Capitalisation data from IMF and Stock Price Index from QSE

2.8 UAE Stock Price Overview

2.8.1 History

The Abu Dhabi Securities Exchange (ADX) was established under Local Law No. 3 in November 2000 to execute the following functions:

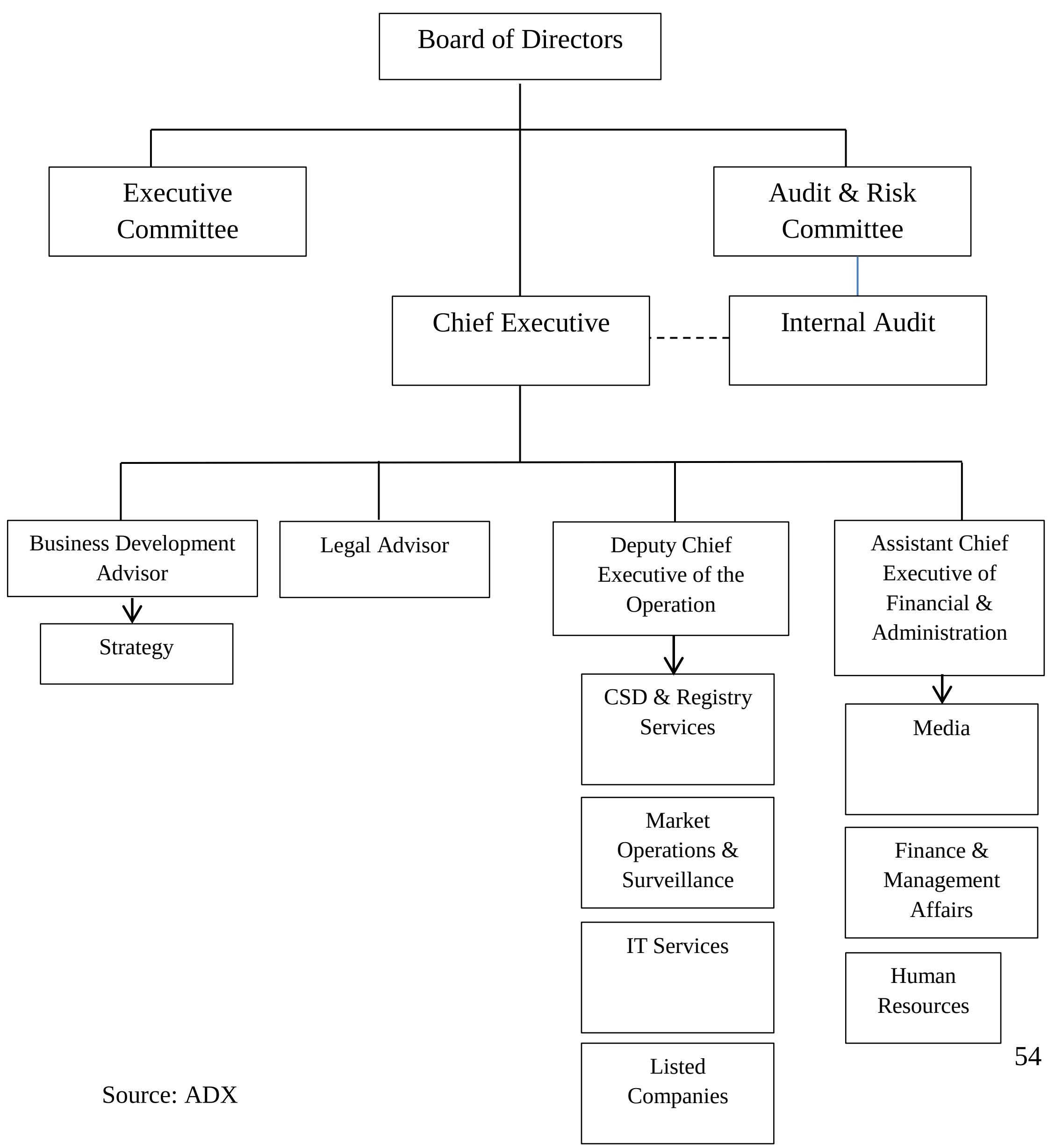
- Provide opportunities for investment that would in turn support the UAE's economy.
- Ensure the accuracy and soundness of orders and transactions, as well as the regulation of the price discovery process.
- Protect domestic and foreign investors with proper dealing principles and fair trading.
- Impose rigorous controls on transactions to ensure sound procedures.
- Develop investment awareness of market participants by issuing recommendations, studies and research material.

- Ensure economic and financial stability, as well as the stability of financial prices and liquidity.

Since 2002, the ADX has had the authority to create branches and centres inside and outside the Emirate of Abu Dhabi. More recently, the ADX opened four branches in Sharjah, Ras al Khaimah, Zayed City and Fujeirah.

2.8.2 Organisation Structure

Figure 2.30: Organisational Structure of the ADX



Source: ADX

2.8.3 Trading System

- The trading session is the time period during which a transaction is registered, changed or cancelled and the order is executed.
- The opening price is the balance price computed by the ADX trading system upon registering, adjusting or cancelling any transaction on the relevant financial instrument.
- The closing price is the weighted average price of the trading orders implemented in the trading session for a particular financial instrument (the total value of traded shares for a security divided by the total number of outstanding shares) or the last closing price if no trading has been made on such security.
- The order log book is an entry that includes all buy-and-sell orders for a certain financial instrument.
- Regular orders are issued to buy or sell a particular security with no conditions. These orders are given priority over special orders with a similar price.
- Special orders are issued to buy or sell a financial instrument with special conditions.
- Corresponding orders are registered by an advisory investment firm (broker) on the ADX trading system, including the sale and purchase of a particular financial instrument with the same firm at a similar price.
- A price tick is the rate of price decrease or increase under which orders and requests are elevated or dropped. A price tick in the debt instrument market is AED0.01.

- A general index is a statistical tool used to measure changes in the equity prices of listed companies weighed by market value.

Transactions/orders should be registered through the framework of the price ticks specified by the ADX trading, as shown in Table 2.7.

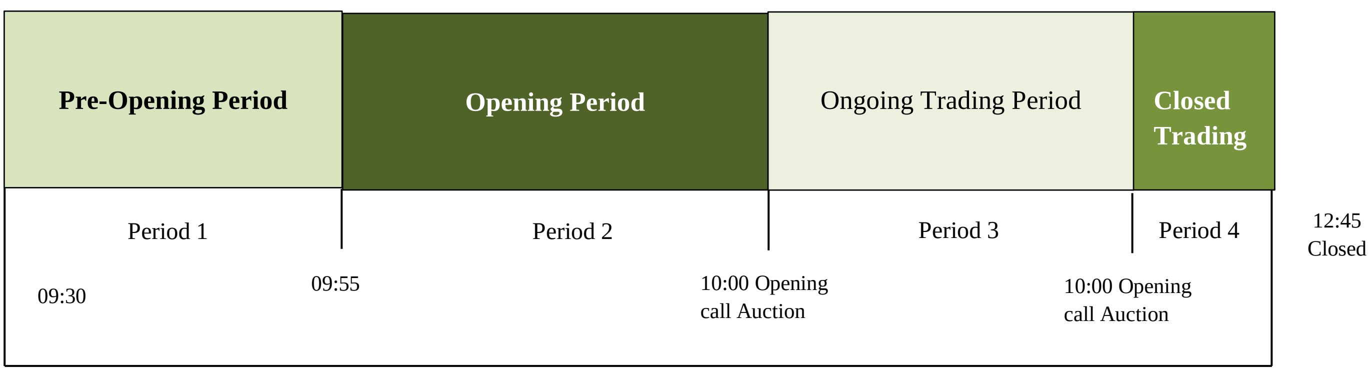
Table 2.7: ADX Trading Fees

Price Range (AED)		
From	To	**Price Ticks (AED)**
0.01	10.00	0.01
10.05	100.00	0.05
100.10	Above	0.10

Source: ADX

2.8.4 Trading Mechanisms

Figure 2.31: ADX Trading Mechanism



Source: ADX

In period 1, transactions/orders may be registered, modified or cancelled, and the information available can be revised by the ADX trading system. Valid and unexecuted orders from a day earlier can be carried forward through the same period. The ADX trading system places the transactions/orders registered on the trading system in accordance with the priority rules. No trades will be implemented at this stage. The trading system computes the opening price of the traded securities for each listed company. In addition, all buy orders registered during this period will be displayed at a price that is higher than or equal to the opening price, while sell orders are registered at a price that is less than or equal to the opening.

In period 2, buy-and-sell transactions/orders are implemented constantly. An advisory investment firm (a broker) might adjust, suspend, cancel or trigger any partially executed or unexecuted orders. During this period, if a buy order is registered at a price that is equal to or higher than the opening price, the order price is displayed on the sell side. Alternatively, a sell order registered at a price that is equal to or less than the opening price is displayed on the buy side. Implementation is executed at the price displayed on the other side. In addition, if a buy or sell order is registered for an executable quantity at more than a unique price during this period, the order will be implemented in accordance with the existing price chain on a priority basis until the total quantity is implemented. If the order is not executed in full, the unexecuted quantity will remain in the orders register of the ADX trading system. In period 3, all information and data are studied and reviewed, all inquiries are made, and needed reports are printed. During this period, an advisory investment firm cannot cancel or modify new or existing orders.

2.8.5 Market Structure

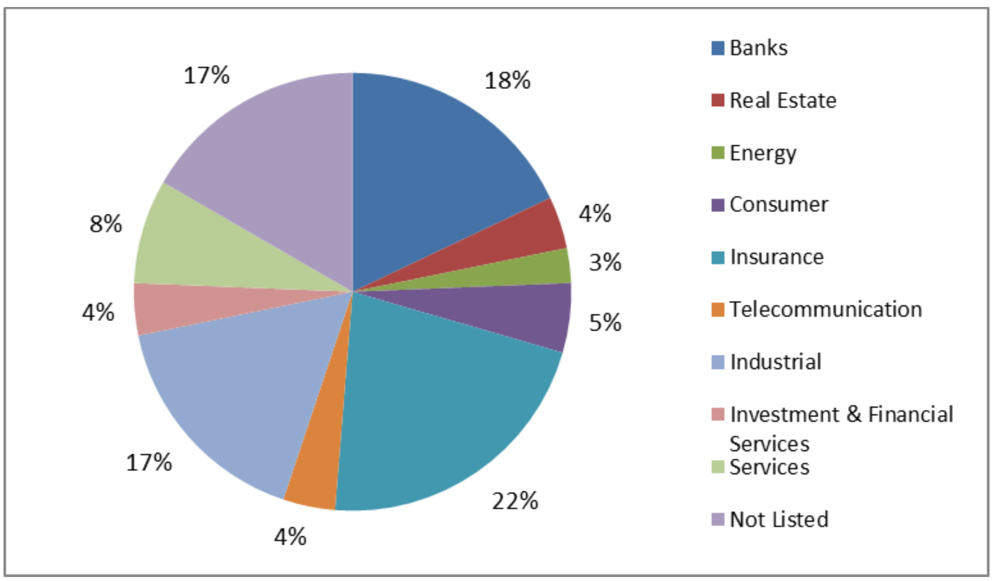
At the end of 2014, the ADX listed 78 companies divided into 10 sectors based on the ADX classification (see Table 2.8 and Figure 2.32). Each sector has its own sub-index.

Table 2.8: ADX Sector Classification at the End of 2014

	Sectors	Total Companies
1	Banks	14
2	Real Estate	3
3	Energy	2
4	Consumer	4
5	Insurance	17
6	Telecommunication	3
7	Industrial	13
8	Investment & Financial Services	3
9	Services	6
10	Not Listed	13

Source: ADX

Figure 2.32: Total Companies Listed in Each Sector of the ADX at the End of 2014



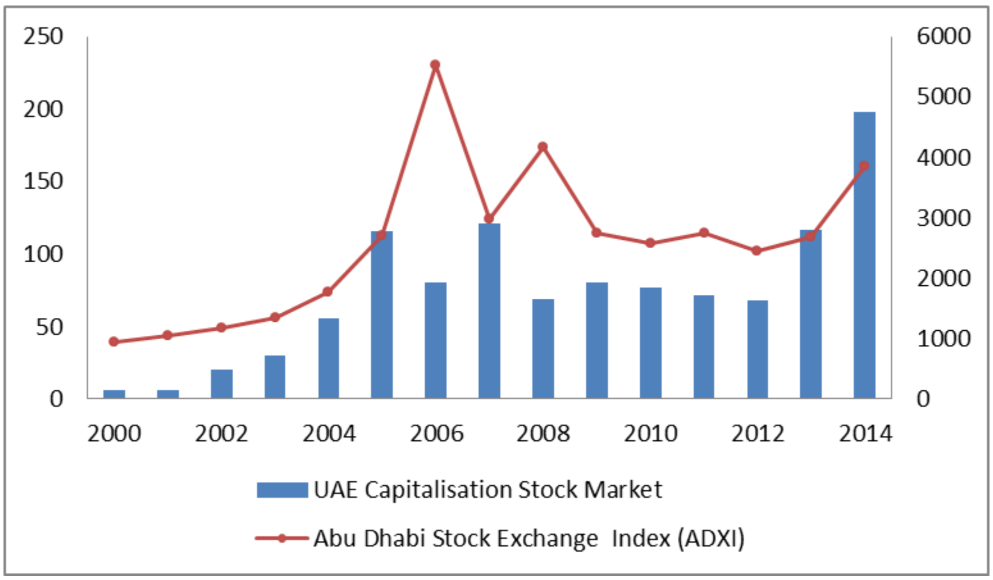
Source: ADX

2.8.6 Index and Market Capitalisation

Figure 2.33 shows the changes in the ADX index and market capitalisation from 2000 to 2014. In 2014, the index declined slightly by 0.58 per cent compared with 2013. Market capitalisation increased dramatically by 71.20 per cent in 2013. At the end of December

2013, it stood at US$116.30 billion, rising to US$198.31 billion at the end of December 2014, which was an all-time high. Banks, telecommunication and real estate are the dominant sectors based on the ADX statistics. The Abu Dhabi Commercial Bank, Abu Dhabi Islamic Bank, Commercial Bank International, Al Dar Properties Co., Emirates Telecommunication Corp and RAK Properties are the six largest companies, accounting for around 79.8 per cent of the total market. Some small sectors have a large number of listed companies—for example, the insurance, industrial and services sectors comprise 36 listed companies, but they account for only 9.35 per cent of the total market value.

Figure 2.33: ADX Index and Market Capitalisation



Source: Capitalisation data from IMF and Stock Price Index from ADX

2.9 Conclusion

Stock markets in the GCC countries have grown and developed quickly over time. As these countries depend primarily on oil (in terms of government revenue, exports and GDP), the performance of their stock market reflects development in the international crude oil market. Thus, these countries provide a good case study of the effects of oil prices on stock prices. Unlike oil-importing countries, where stock prices and oil prices move in different directions, stock prices in GCC countries move in the same direction as oil prices. This observation has been confirmed by existing empirical evidence.

Chapter 3: Relationship between Exchange Rates and Stock Prices

3.1 Introduction

The relationship between exchange rates and stock prices has attracted the attention of policy makers, economists and investors, as these financial prices play a crucial role in the macro economy (Lee and Nieh 2001). Although the available evidence largely indicates the absence of a long-term relationship between stock prices and exchange rates (Sohrabian and Bahmani-Oskooe 1992; Lee and Nieh 2001; Ramasay and Yeung 2005), this relationship continues to be a source of contention and investigation.

The empirical work conducted this study is based on time series for exchange rates and stock prices. Although these financial prices behave in a similar fashion, as they are driven by news and other factors, there is a notable difference in their behaviour. Stock prices tend to move along a secular upwards trend arising from the growth and development of the economy, but this secular trend is interrupted by cycles of bear and bull markets. In contrast, exchange rate movements are dominated by cycles and do not exhibit long-run trends. Unless a country is experiencing hyperinflation, its exchange rate cannot fall or rise without bounds over a long period. This is particularly the case for the GCC currencies, which are pegged to the US dollar, except for the Kuwaiti currency, which is pegged to a basket of currencies. Therefore, it is of interest to determine whether changes in stock prices cause changes in exchange rates, or vice versa.

3.2 Literature Review

Theoretical considerations lead to the proposition that exchange rates and stock prices are related (Dornbusch and Fischer 1980; Aggerwal 1981; Yau and Nieh 2006). The portfolio balance approach indicates that the exchange rate is influenced by the mechanism of the stock market. That is, portfolio theories focus on the significant role of capital account transactions in determining exchange rate dynamics (Mehdian, Friedman and Ajayi 1998; Hatemi and Irandoust 2002; Ravazzolo and Phylaktis 2005; Hatemi and Roca 2004; Thoma 2008). However, there is neither a theoretical nor an empirical consensus on the relationship between stock prices and exchange rates, and it is not clear whether this relationship is causal in one direction or both directions.

According to Johnston and Sun (1997), who examined exchange rate risk pricing in the US stock market, US companies exhibit significant cross-sectional differences in their exposure to foreign exchange risk. Murinde and Abdalla (1997) evaluated the interaction between stock prices and exchange rates in some emerging markets, including the Philippines, Pakistan, India and Korea. Their results showed the presence of unidirectional causality from stock prices to exchange rates in the Philippines, India and Pakistan, as well as causality from exchange rates to stock prices in Korea. Roca and Hatemi (2005) criticised previous empirical research for using sample periods characterised by normal conditions instead of good and bad times. They pointed out that stock prices and exchange rates were strongly related during the period before the Asian financial crisis. The direction of causality was from stock prices to exchange rates in the case of Thailand and Indonesia, and from exchange rates to stock prices in the case of the

Philippines. No causality was found in the case of Malaysia or for the period encompassing the financial crisis.

Ajay, Friedman and Mehdian (1998) examined the causal relation between exchange rates and stock prices using the Granger causality test. They found unidirectional causality from changes in the exchange rate to stock return differential in all industrial markets, whereas a consistent causal linkage was observed in emerging stock markets, with the exception of the Philippines and Indonesia, where the direction of causality was from exchange rates to stock prices. Irandoust and Hatemi (2002) employed the Granger test to study the relation between stock prices and exchange rates in Sweden. They found that causality is unidirectional, running from the currency market to the stock market. In fact, they found that an increase in Swedish stock prices leads to currency depreciation. Another study that supports the portfolio balance approach is that of Ravazzolo and Phylaktis (2005), who examined the underlying propositions for Thailand, Indonesia, Hong Kong, Malaysia and Indonesia. Their found no long-term relationship between stock prices and real exchange rates in all countries. Further, they found that stock prices are positively related to exchange rates. Bodnar and Bartov (1994), Lee and Nieh (2001), Muhammad and Rasheed (2002), Ravazzolo and Phylaktis (2005) and Uddin and Rahman (2009) indicated that exchange rates are not influenced by changes in stock prices, and vice versa. In contrast, others have found bidirectional causality between exchange rates and stock prices (e.g., Sohrabian and Bahmani-Oskooee 1992; Ajayi and Mougoue 1996; Aydemir and Demirhan 2009).

Research on this issue is predominantly based on two-variable regressions to study the relationship between exchange rates and stock prices; thus, the problem of missing variables has been neglected. Nonetheless, previous studies have established that the exclusion of relevant variables from a system might invalidate the causality inference between the variables of an incomplete system. The underlying argument—that any change in one of the variables causes changes in another variable drawn from a bivariate causality test—may be invalid because of the omission of significant variables (Caporale, Howells, and Soliman 2004).

3.3 Methodology

This section presents the methodology used, starting with the unit root test, followed by cointegration analysis and then causality.

3.3.1 Unit Root Test

Specifying a regression equation in levels rather than first differences may be problematical. Newbold and Granger (1974) presented some results indicating that when time series variables are non-stationary, using levels may result in a non-constant mean over time and a residual that is highly autocorrelated, with a low Durbin–Watson statistic. For this reason, Newbold and Granger recommended the use of the first difference of each variable before running the regression. Schwert and Plosser (1978) noted that in an undifferenced regression, the disturbance term is non-stationary and is not well behaved. They concluded that it is better to work with differenced economic data rather than data in levels for most economic time series. Therefore, one must exercise care when using data in levels rather than differences. Griffiths, Carter, and Hill (1993) argued that 'the usual statistical properties of least squares hold only when the time series variables involved are stationary'. Accordingly, non-stationary time series have to be differenced before performing econometric analysis.

In this chapter, we use the augmented Dickey–Fuller (ADF) unit root test. According to Schwert (1989), the ADF test with long lags outperforms the corresponding model without lags. Therefore, the model used in this study is specified as follows:

$$\Delta y_t = \alpha + \varphi y_{t-1} + \sum_{i=1}^{n} \beta_i \, \Delta y_{t-i} + \epsilon_t \tag{3.1}$$

where Δ is the first difference operator. The test is applied to stock prices SP_t and exchange rates ER_t. The corresponding equations are:

$$\Delta SP_t = \beta_0 + \varphi_1 SP_{t-1} + \sum_{i=1}^{n} \beta_i \, \Delta SP_{t-i} + \varepsilon_{1t} \tag{3.2}$$

and:

$$\Delta ER_t = \alpha_0 + \varphi_2 ER_{t-1} + \sum_{i=1}^{n} \alpha_i \, \Delta ER_{t-i} + \varepsilon_{2t} \tag{3.3}$$

where $\Delta SP_t = SP_t - SP_{t-1}$ and $\Delta ER_t = ER_t - ER_{t-1}$. The null of non-stationarity (unit root) is $H_0: \varphi = 0$, whereas the alternative of stationarity (absence of unit root) is $H_1: \varphi < 0$.

3.3.2 Cointegration Testing

Cointegration is used to detect the existence of an equilibrium relationship between any two or more variables. Engle and Granger (1987) proposed a two-step approach to cointegration when the variables (stock prices and exchange rates) are I(1). The first step involves estimating the long-run equation by ordinary least squares (OLS) and then applying the ADF test to the residuals. Engle and Granger (1987) provided the critical values of the test statistics. Therefore, the test involves two equations:

$$y_t = \delta_0 + \delta_1 x_t + u_t \tag{3.7}$$

and:

$$\Delta u_t = \eta u_{t-1} + \sum_{i=1}^{n} \emptyset_i \Delta u_{t-i} + v_t \tag{3.8}$$

The OLS estimates of the coefficients of the cointegrating regression are super consistent in the presence of cointegration, even though the usual standard error is not reliable. If the residual is found to be non-stationary, then the two variables (exchange rate and stock price) are not cointegrated and the findings are possibly spurious. However, if the residual is stationary, then there is a meaningful long-run relationship between exchange rates and stock prices.

3.3.3 Causality Testing and the Vector Autoregression Model

To examine the relationship between stock prices and exchange rates, we must determine whether the exchange rate causes the stock price to change, or vice versa. In this chapter, we use the vector autoregression (VAR) model to examine linear causality between these two variables. The use of VAR models can be justified in terms of the meaning of causality in economics, where it is not really causality in the same sense as it is in natural sciences. In economics (and finance) something causes something else because it occurs before the something else. A variable causes another if its lagged values can explain variation in the dependent variable over and above what can be explained by lagged dependent variables. For this reason a model with lagged dependent and explanatory variables is needed to conduct causality testing.

For this purpose, the following two equations are used if there is no cointegration between the two variables:

$$\Delta SP_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \; \Delta SP_{t-i} + \sum_{i=1}^{n} \beta_{2i} \; \Delta ER_{t-i} + \epsilon_{1t} \tag{3.9}$$

and:

$$\Delta \mathrm{ER}_t = \beta_0 + \sum_{i=1}^{n} \beta_{1i} \; \Delta ER_{t-i} + \sum_{i=1}^{n} \beta_{2i} \; \Delta SP_{t-i} + \epsilon_{2t} \tag{3.10}$$

The possibilities are as follows: (i) causality from stock prices to exchange rates ($SP_t \rightarrow ER_t$); (ii) causality from exchange rates to stock prices ($ER_t \rightarrow SP_t$); (iii) independence between exchange rates and stock prices; and (iv) and feedback causality between stock prices and exchange rates. If exchange rates and stock prices are cointegrated, the VAR model must include an error correction term (ECT), in which case the equations become:

$$\Delta SP_t = \beta_0 + \vartheta_1 \left(SP_{t-1} - \delta ER_{t-1}\right) + \sum_{i=1}^{n} \beta_{1i} \; \Delta SP_{t-i} + \sum_{i=1}^{n} \beta_{2i} \; \Delta ER_{t-i}$$

$$+ \varepsilon_{st} \tag{3.11}$$

and:

$$\Delta ER_t = \alpha_0 + \vartheta_2 \left(SP_{t-1} - \delta ER_{t-1}\right) + \sum_{i=1}^{n} \alpha_{1i} \; \Delta ER_{t-i} + \sum_{i=1}^{n} \alpha_{2i} \, \Delta SP_{t-i}$$

$$+ \varepsilon_{st} \tag{3.12}$$

where ϑ_1 and ϑ_2 are the coefficients on the ECTs.

3.4 Data

This empirical work is based on monthly time series data on exchange rates and stock prices over the period 1 January 2000 to 31 December 2013. The data were collected from Datastream, with the exception of the share prices of Bahrain, Oman and the UAE, which were obtained from each country's stock exchange website. Table 3.1 lists the countries, exchange rates and stock market indices.

Table 3.1: Countries, Currencies and Stock Market Indices

Country	Index	Currency
Kuwait	KSE	KWD
Saudi Arabia	SSE	SAR
Bahrain	BBE	BHD
Oman	MSE	OMR
Qatar	QSE	QAR
UAE	ADX	AED

3.5 Unit Root Test—Results

The results obtained using the ADF test for the unit root are displayed in Table 3.2. H_0 is that ER_t and SP_t contain a unit root against H_a (alternative hypothesis) that both variables are stationary under consideration. Table 3.2 shows that the null hypothesis—that SP_t and ER_t have a unit root—cannot be rejected. Nevertheless, the H_0 of unit roots is rejected after the exchange rate and stock price variables have been put in first difference. This suggests that the variables are I(1).

Figures 3.1–3.18 show the exchange rates series and stock price series of the GCC countries. As shown in these figures, the exchange rates have similar cycles, which is due to the pegging of the exchange rates to the USD. That is, when the USD depreciates (appreciates) against the GBP and JPY, GCC currencies depreciate (appreciate) against the same currencies. Kuwait is the only exception, as the currency is pegged to a basket of currencies.

GCC stock prices increased gradually during the sample—for example, from 2000 to 2008, stock prices increased by more than 120 per cent. However, after the global financial crisis, most GCC stock markets declined gradually until the end of 2012. Although GCC stock prices and exchange rates have been moving in the same direction, there is no indication of stock indices being responsive to exchange rates, and vice versa. In addition, the figures show how stock prices and exchange rates in first differences behave.

Table 3.2: Results of Testing for Unit Root

Variables	Level	First Difference	Order of Integration
Kuwait Perspective			
SP_t	-1.559321	8.662193 ***	(1)
$ER_{t,KWD/GBP}$	-2.374937	-9.449167***	(1)
$ER_{t,KWD/JPY}$	-1.381478	-16.52882***	(1)
Saudi Perspective			
SP_t	-1.972518	-9.549047***	(1)
$ER_{t,SAR/GBP}$	-1.622082	-3.8452258***	(1)
$ER_{t,SAR/JPY}$	-0.543151	-10.49670***	(1)
Bahrain Perspective			
SP_t	-1.559321	-8.662193***	(1)
$ER_{t,BHD/GBP}$	-2.374937	-16.52882***	(1)
$ER_{t,BHD/JPY}$	-0.584228	-10.85234***	(1)
Oman Perspective			
SP_t	-1.407224	-5.556350***	(1)
$ER_{t,OMR/GBP}$	-1.475810	-3.566934***	(1)
$ER_{t,OMR/JPY}$	-0.522623	-10.60504***	(1)
Qatar Perspective			
SP_t	-1.760733	-10.96800***	(1)
$ER_{t,QAR/GBP}$	-3.566924	-12.29055***	(1)
$ER_{t,QAR/JPY}$	-0.532293	-11.38497***	(1)
UAE Perspective			
SP_t	-1.728599	-9.980290***	(1)
$ER_{t,AED/GBP}$	-1.376321	-3.198712***	(1)
$ER_{t,AED/JPY}$	-0.550604	-10.56989***	(1)

Notes: The number of lags is provided in parentheses. ADF—critical values are at 1% = -4.04, 5% = -3.43 and 10% =-3.14. ***, ** and * indicate statistical significance at 1, 5 and 10 per cent respectively.

Figure 3.1: Kuwait Stock Market Index in Level and First Difference

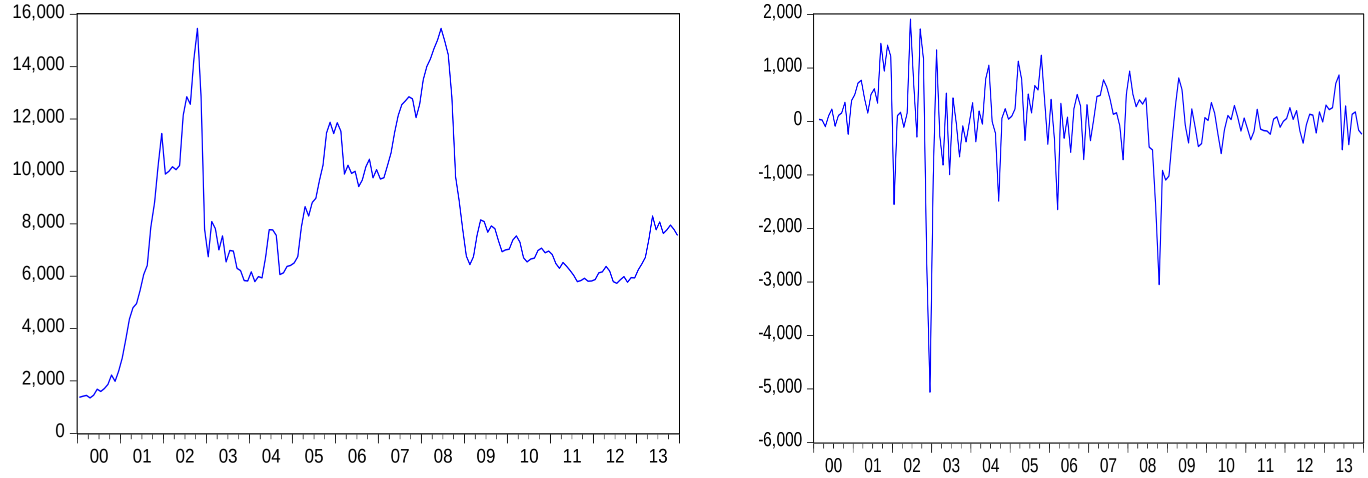


Figure 3.2: KWD/GBP Exchange Rate in Level and First Difference

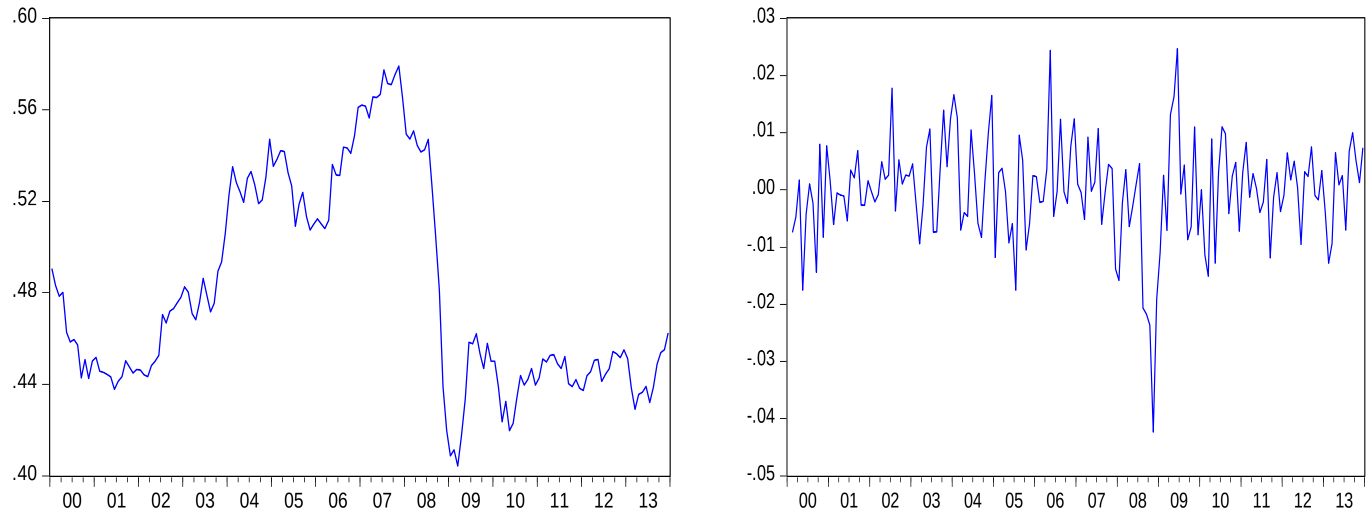


Figure 3.3: KWD/JPY Exchange Rate in Level and First Difference

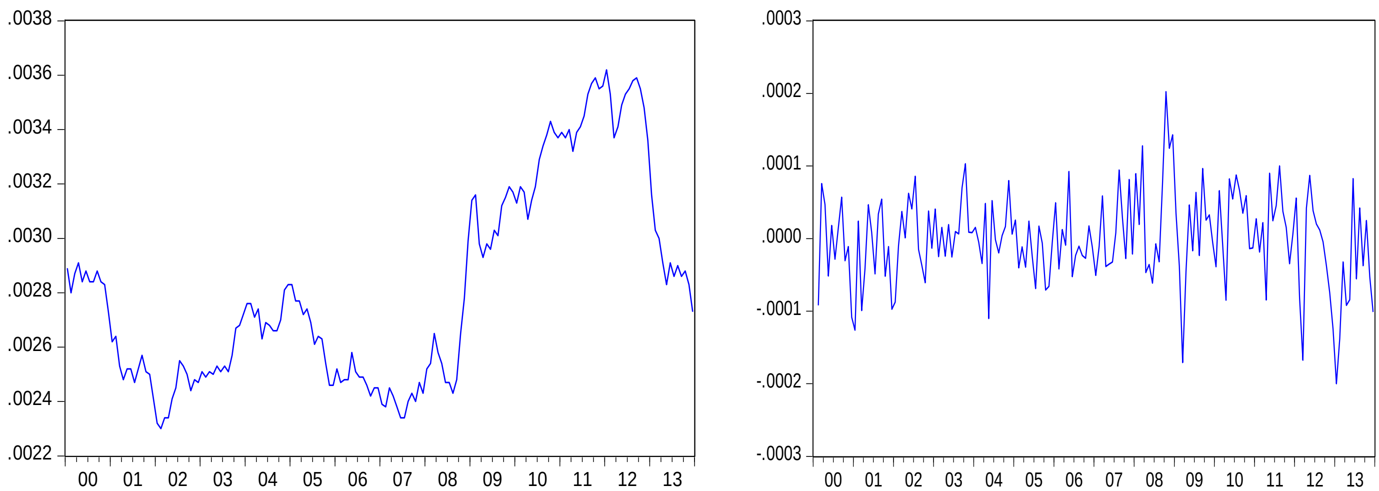


Figure 3.4: Saudi Stock Market Index in Level and First Difference

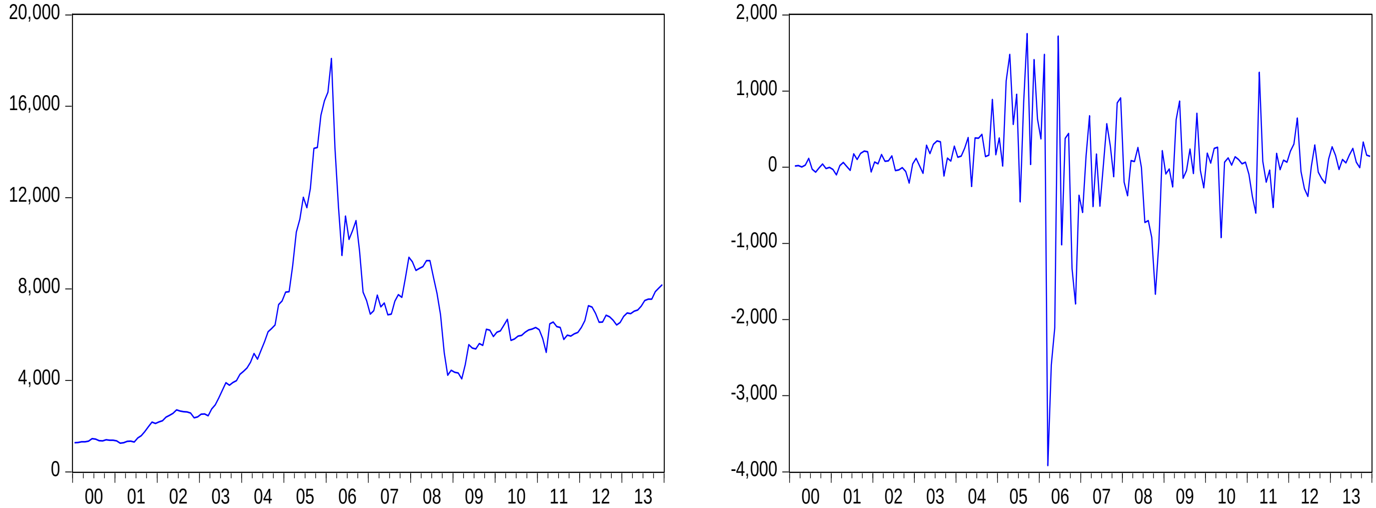


Figure 3.5: SAR/GBP Exchange Rate in Level and First Difference

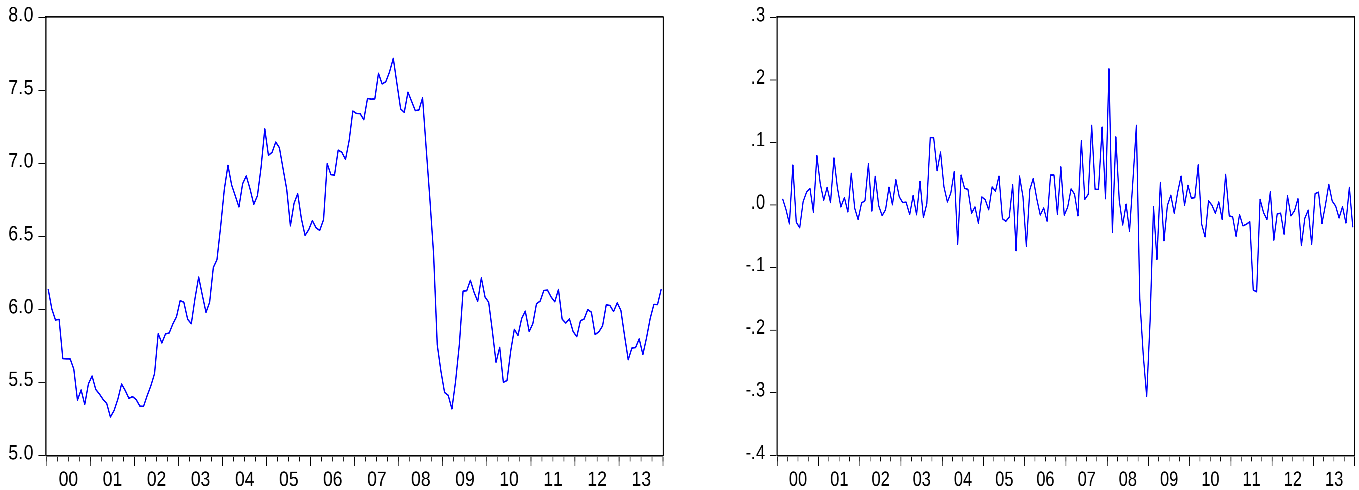


Figure 3.6: SAR/JPY Exchange Rate in Level and First Difference

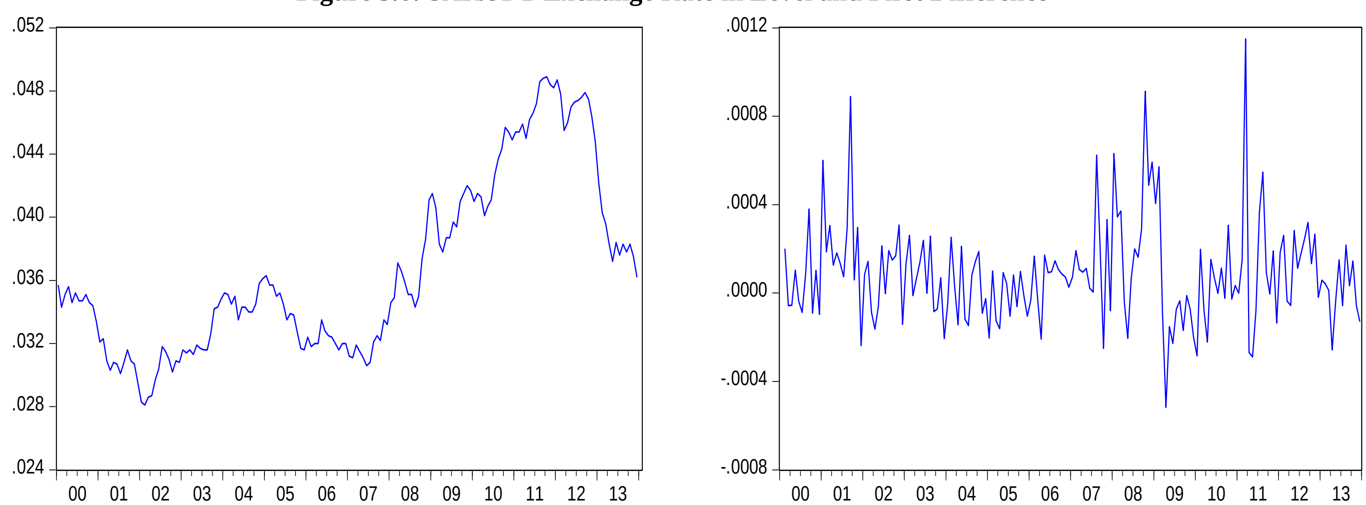


Figure 3.7: Bahrain Stock Market Index in Level and First Difference

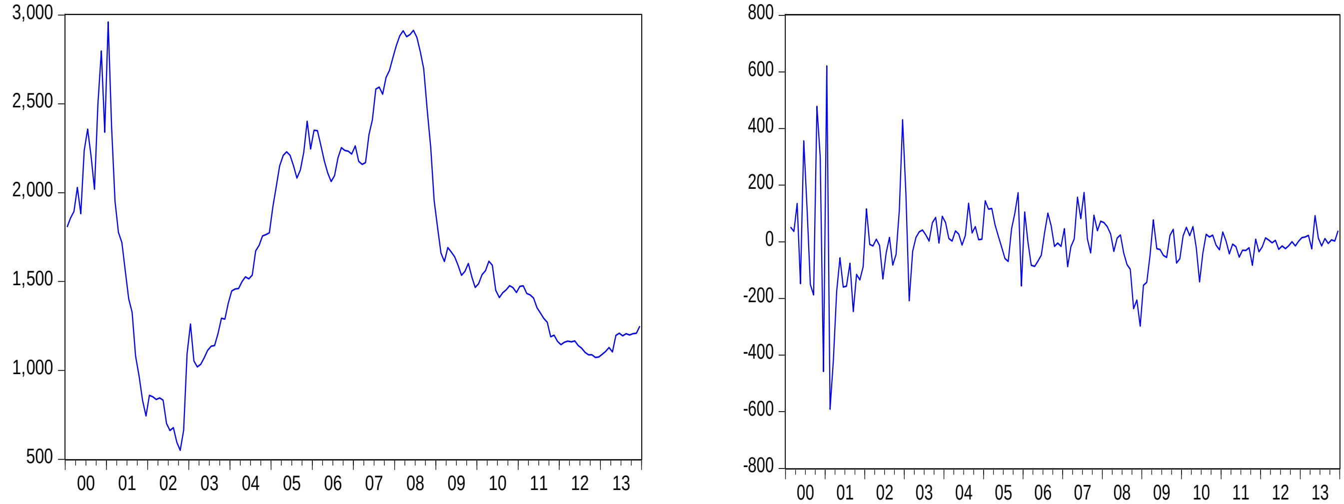


Figure 3.8: BHD/GBP Exchange Rate in Level and First Difference

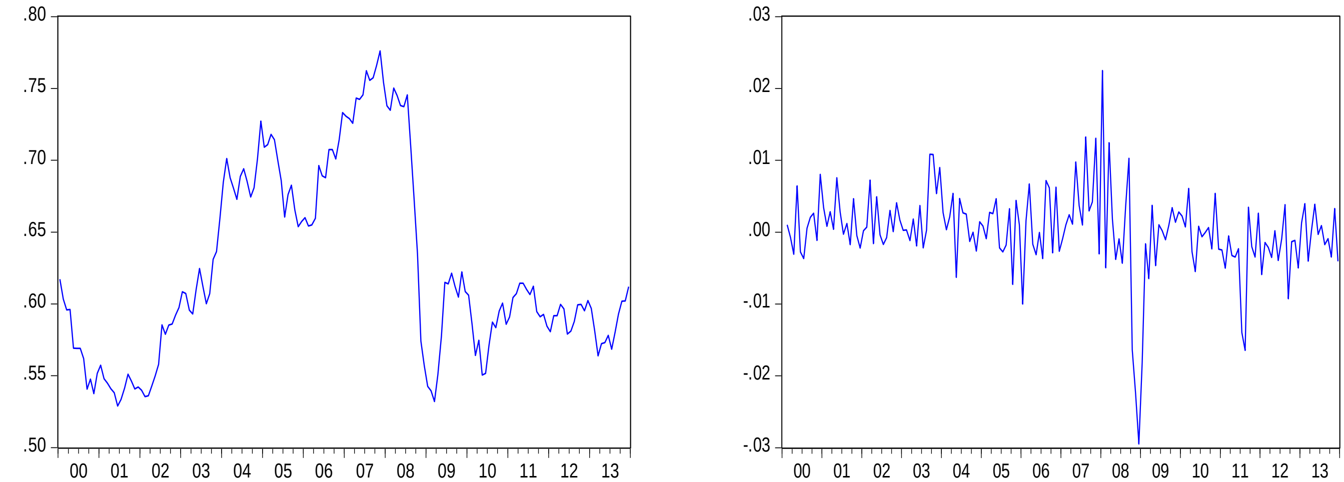


Figure 3.9: BHD/JPY Exchange Rate in Level and First Difference

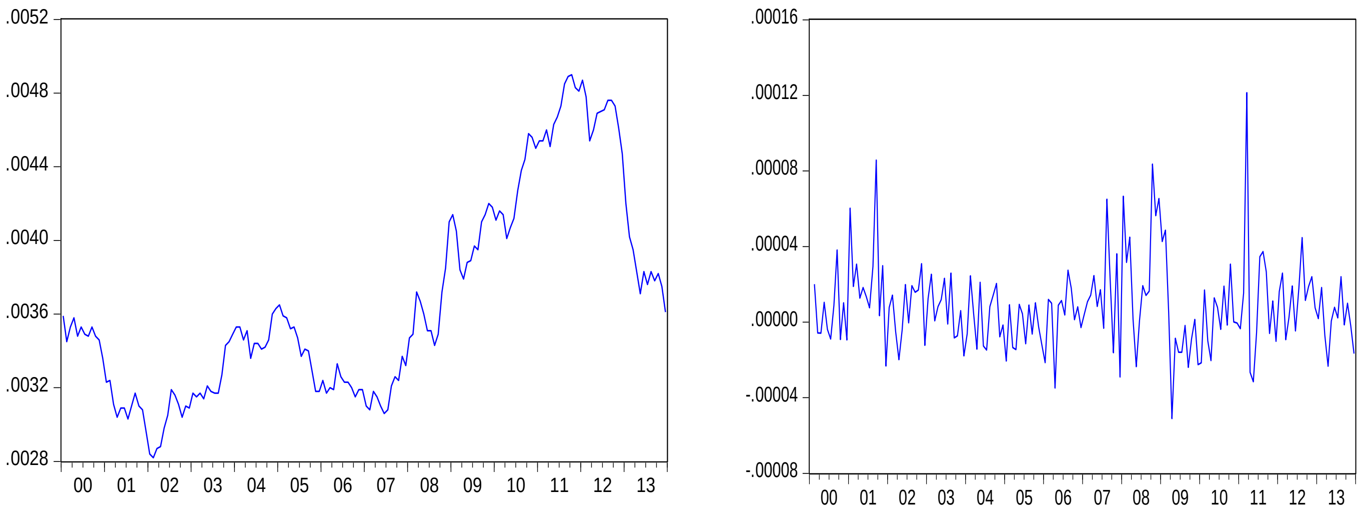


Figure 3.10: Oman Stock Market Index in Level and First Difference

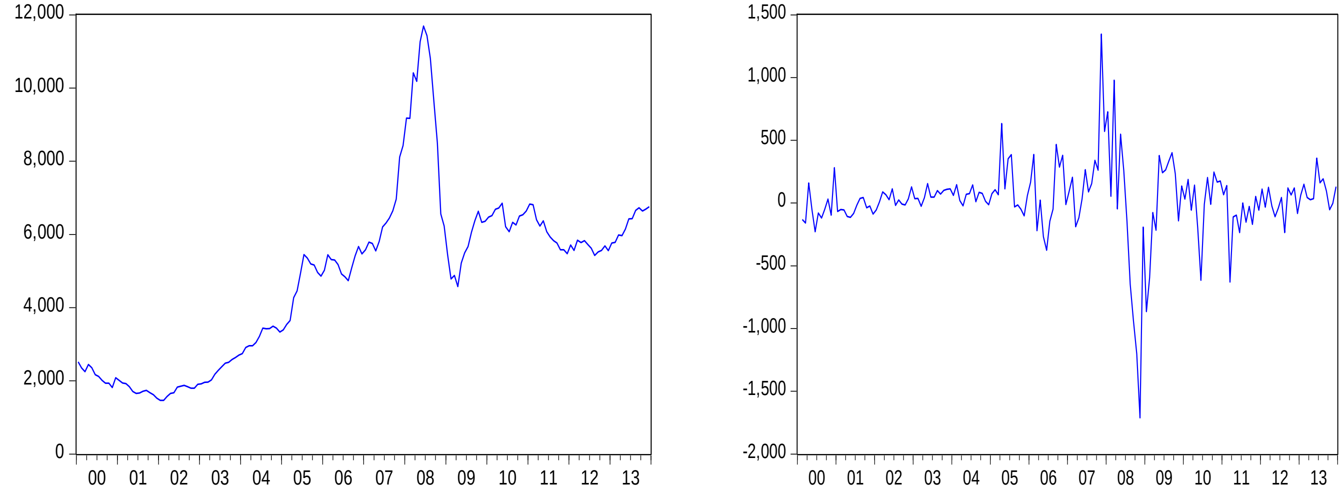


Figure 3.11: OMR/GBP Exchange Rate in Level and First Difference

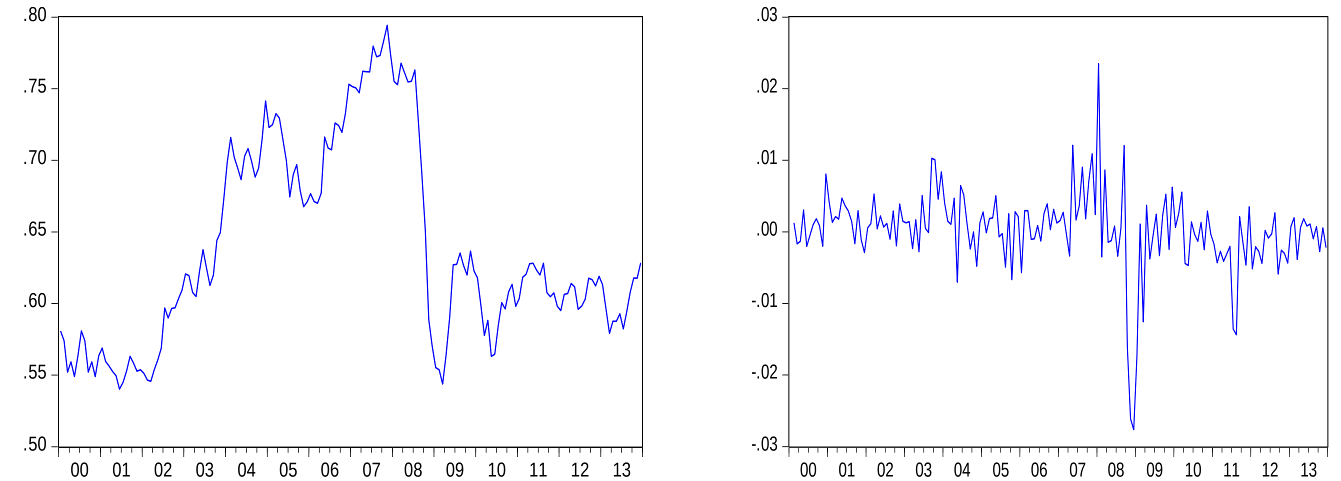


Figure 3.12: OMR/JPY Exchange Rate in Level and First Difference

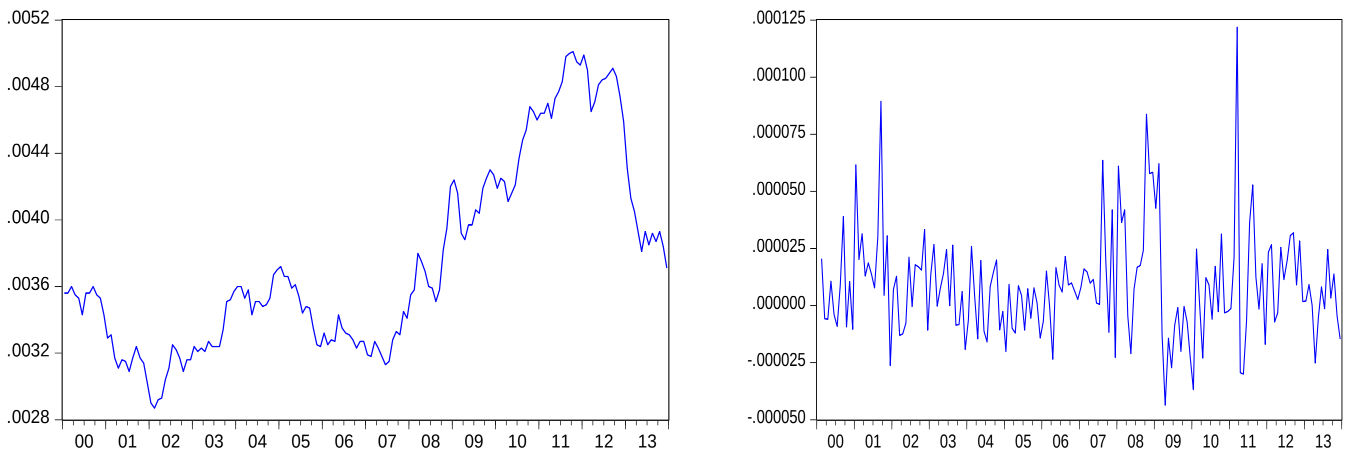
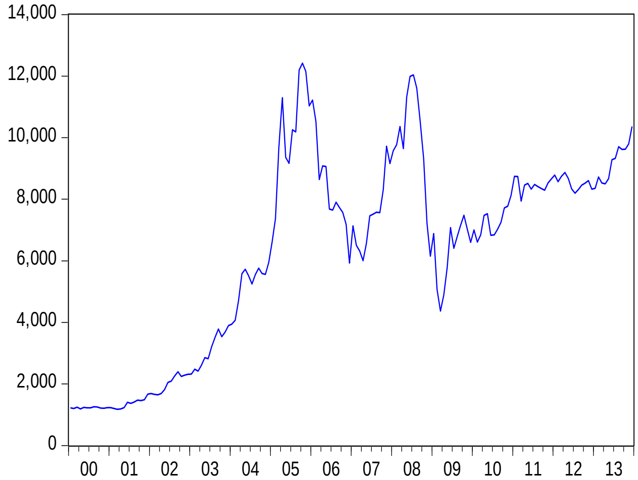


Figure 3.13: Qatar Stock Market Index in Level and First Difference



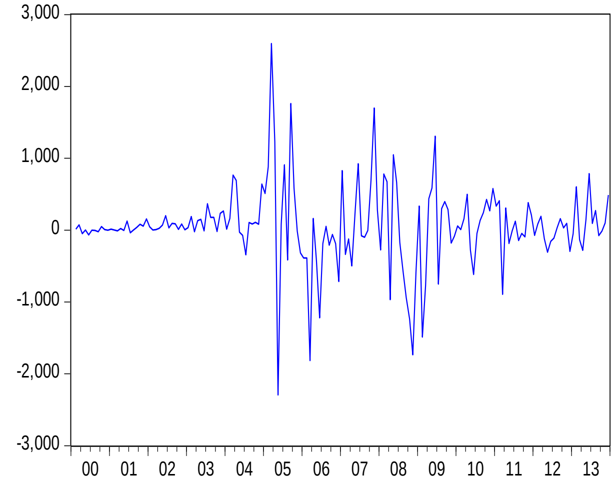
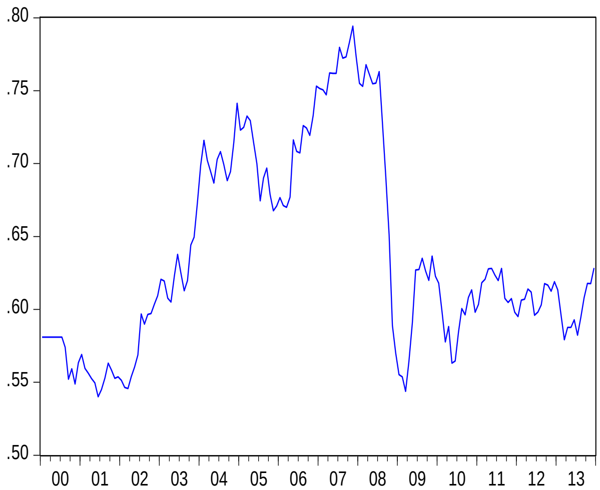


Figure 3.14: QAR/GBP Exchange Rate in Level and First Difference



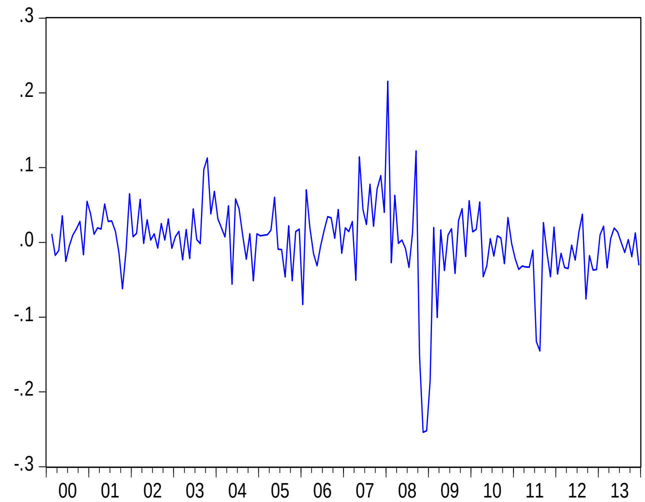
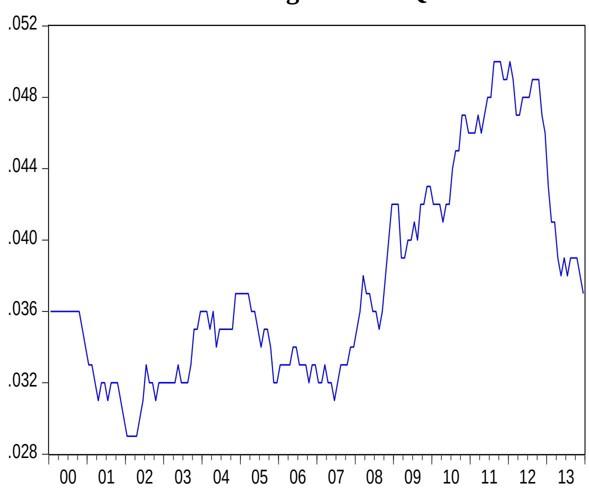


Figure 3.15: QAR/JPY Exchange Rate in Level and First Difference



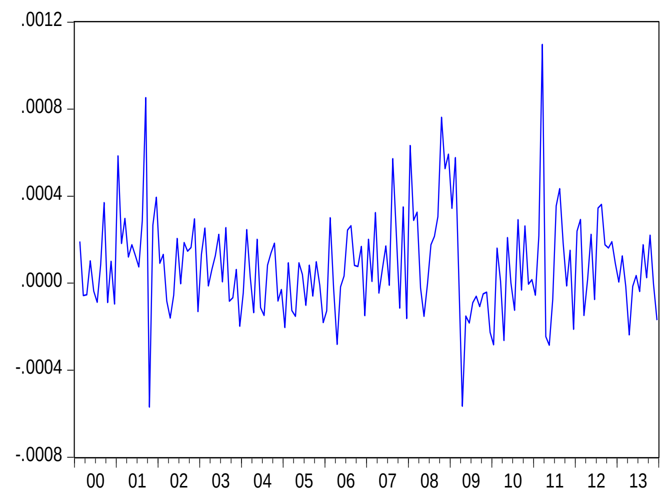


Figure 3.16: UAE Stock Market Index in Level and First Difference

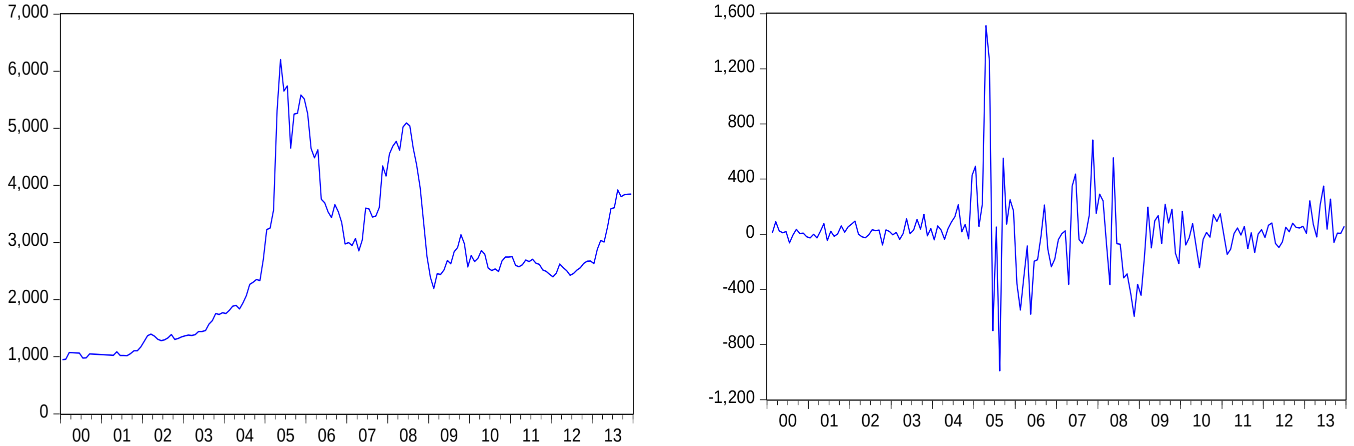


Figure 3.17: AED/GBP Exchange Rate in Level and First Difference

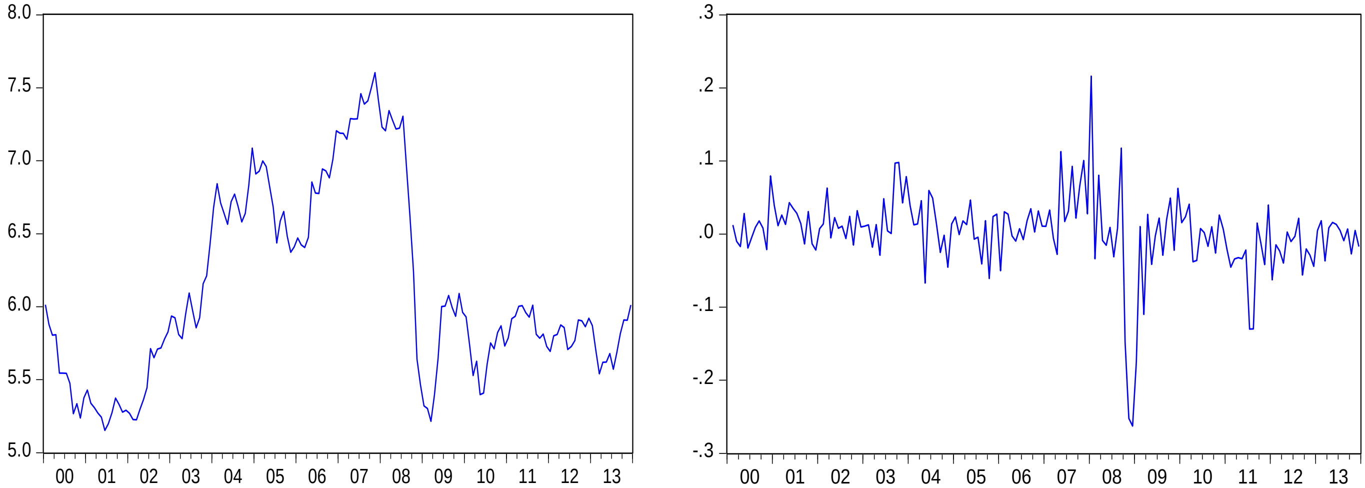
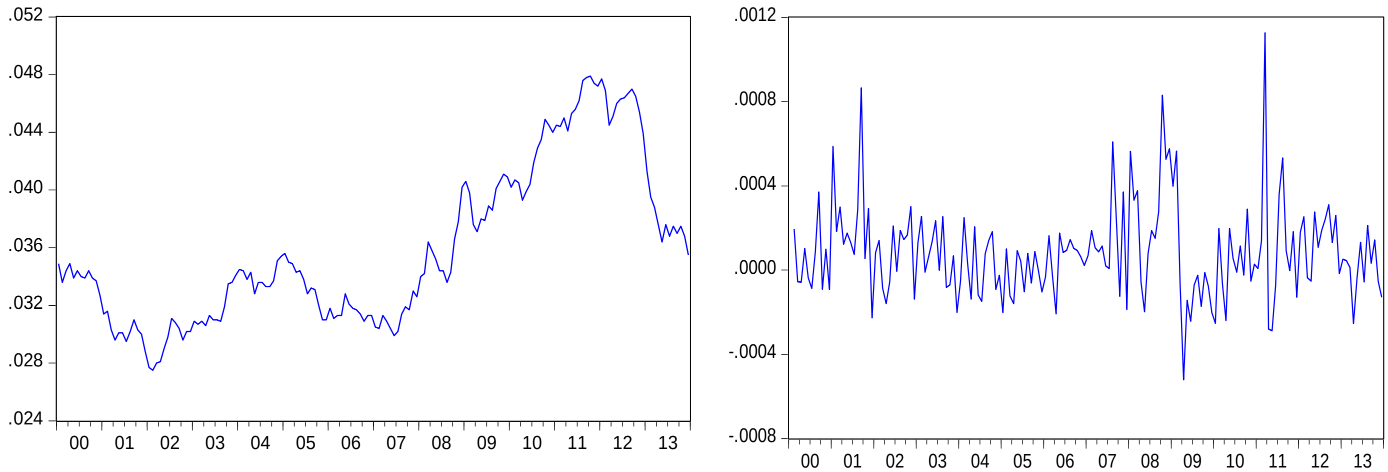


Figure 3.18: AED/JPY Exchange Rate in Level and First Difference



3.6 Cointegration Analysis—Results

After testing for stationarity of stock prices series and exchange rates series, we moved to cointegration analysis. Two methods were used to test for cointegration: the residual-based method and the error correction method.

3.6.1 Bivariate Cointegration Test Analysis: Residual-Based Method

For residual-based bivariate cointegration analysis, Equation (3.8) is estimated, and the residual is extracted and tested for the unit root. Table 3.3 shows the ADF statistics corresponding to the maximum Akaike's Information Criterion (AIC) for the ADF regressions of the residual ranging from order 0 to order 10.

Table 3.3: Results of Testing Bivariate C-integration: Residual-based Method

Kuwait Stock Market	KWD/GBP -3.3157**	KWD/JPY -3.1442**
Saudi Stock Market	SAR/GBP -1.7951	SAR/JPY -1.8703
Bahrain Stock Market	BHD/GBP -3.7268*	BHD/JPY -2.4755
Oman Stock Market	BHD/GBP -0.3461	BHD/JPY -3.1623**
Qatar Stock Market	QAR/GBP -0.7334	QAR/JPY -2.4170
UAE Stock Market	AED/GBP -1.4742	AED/JPY -2.1454

Notes: * and ** indicate statistical significance at 1 and 5 per cent respectively. The critical values for cointegrating relations (with a constant in the cointegrating vector) are estimated using the Engle–Granger methodology. Critical values are interpolated using the response surface in Engle and Granger (1987).

The results reported in Table 3.3 show that, with the exception of that between the market index and exchange rate series in Kuwait, Bahrain and Oman, failed to reject the null hypothesis of no cointegration. Hence, cointegration appears between the Kuwait stock market index and exchange rate (KWD/JPY) series, between the Kuwait stock market index and exchange rate (KWD/GBP) series, between the Bahrain stock market index and exchange rate (BHD/JPY) series, and between the Oman stock market index and exchange rate (OMR/JPY) series.

3.6.2 Bivariate Cointegration Analysis: Error Correction Model

According to Granger's representation theorem, cointegration implies and is implied by the existence of a valid error correction representation. Hence, it is possible to test for cointegration by estimating the error correction model (ECM) and testing its validity. The test of cointegration depends on the significance of ϑ_1 and ϑ_2 in Equations (3.11) and (3.12) respectively. It is worth noting that the coefficients must be significantly negative in the ECM. The maximum lag(n) length of the ECM is initially specified as four for stock prices and two for exchange rate variables.

Table 3.4: Results of Testing Bivariate Cointegration: Error Correction Model

Kuwait Stock Market	KWD/GBP -0.0691*	KWD/JPY -0.0617*
Saudi Stock Market	SAR/GBP -0.0275	SAR/JPY -0.0316**
Bahrain Stock Market	BHD/GBP -0.0384***	BHD/JPY -0.0228
Oman Stock Market	BHD/GBP -0.0183	BHD/JPY -0.0200
Qatar Stock Market	QAR/GBP -0.0243	QAR/JPY -0.0357***
UAE Stock Market	AED/GBP -0.0338	AED/JPY -0.0330***

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

For bivariate cointegration analysis, the estimation results for Equations (3.11) and (3.12) are reported in Table 3.4, which shows evidence for cointegration between stock market indices and exchange rates (against JPY) for most GCC countries, except Bahrain and

Oman. In addition, there are only two cases of cointegration (Kuwait and Bahrain) between stock prices and exchange rates (against GBP).

3.7 Granger Causality Testing

Having tested for cointegration, we now test for causality between the exchange rates and stock prices. For this purpose, Equations (3.9) and (3.10) are estimated. Prior to applying Granger causality tests, we need to select the appropriate lag length for exchange rates and stock prices using the Schwarz Bayesian information criterion. The optimum lag length for testing causality from exchange rates to stock prices ($ER \rightarrow SP$) is three for exchange rates and two for stock prices. The optimum lag for testing causality from stock prices to exchange rates is four for stock prices and seven for exchange rates. The results are presented in Tables 3.5–3.10

Table 3.5: Causality between KWD/GBP and Kuwait Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	0.347329 0.079947 0.473951	0.230372 0.080744 0.2853126
ΔSP_{t-1} Standard Error t-value	-0.139799 0.084169 -1.660922*	-0.121446 0.083372 -1.456672
ΔSP_{t-2} Standard Error t-value	0.071805 0.080201 0.895311	0.087164 0.078787 1.106330
ΔSP_{t-3} Standard Error t-value	1.68E-06 9.62E-07 1.741842	25.70501 53.11878 0.483916
ΔSP_{t-4} Standard Error t-value	0.227883 0.080108 2.844703	0.035301 0.082567 0.427542
ΔER_{t-1} Standard Error t-value	0.033790 0.082246 0.410837	0.081472 0.082427 0.988417
ΔER_{t-2} Standard Error t-value		0.186132 0.081194 2.292422
ΔER_{t-3} Standard Error t-value		-0.070600 0.082455 -0.856228***
ΔER_{t-4} Standard Error t-value		-0.066886 0.082799 -0.807804
ΔER_{t-5} Standard Error t-value		-0.113052 0.081037 -1.395068
ΔER_{t-6} Standard Error t-value		2.47E-05 0.000638 0.038734
ΔER_{t-7} Standard Error t-value		0.73124 0.052681 1.035428

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.6: Causality between SAR/GBP and Saudi Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	0.296516 0.079870 3.712473	0.267574 0.082910 3.227302
ΔSP_{t-1} Standard Error t-value	0.044724 0.083248 0.53724	0.312538 0.083074 3.762163***
ΔSP_{t-2} Standard Error t-value	-0.078794 0.080681 -0.976613	0.046106 0.087034 0.529746
ΔSP_{t-3} Standard Error t-value	-0.010392 0.0101341 -0.1025416	-0.138988 0.087739 -1.584096
ΔSP_{t-4} Standard Error t-value		0.138513 0.087526 1.582543
ΔER_{t-1} Standard Error t-value	0.248715 0.080157 3.102841	0.213825 0.085953 2.487697
ΔER_{t-2} Standard Error t-value	0.183316 0.080845 2.26751	0.050303 0.086190 0.583629
ΔER_{t-3} Standard Error t-value		-0.125520 0.085886 -1.461475
ΔER_{t-4} Standard Error t-value		0.160801 0.086449 1.860056
ΔER_{t-5} Standard Error t-value		0.085247 0.084911 1.003954
ΔER_{t-6} Standard Error t-value		-0.081818 0.081379 -1.005387
ΔER_{t-7} Standard Error t-value		0.312538 0.083074 3.762163

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.7: Causality between BHD/GBP and Bahrain Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	-3.700990 8.66880 -0.42693	0.000154 0.00041 0.37211
ΔSP_{t-1} Standard Error t-value	0.129544 0.079047 1.638815	0.162189 0.080279 2.020309**
ΔSP_{t-2} Standard Error t-value	0.061128 0.080306 0.76119	0.101389 0.0822 1.233444
ΔSP_{t-3} Standard Error t-value	0.094131 0.07975 1.180327	-0.000533 0.078242 -0.006806
ΔSP_{t-4} Standard Error t-value		0.104801 0.076182 1.375665
ΔER_{t-1} Standard Error t-value	0.193082 0.079704 2.422503	0.206087 0.083429 2.470219
ΔER_{t-2} Standard Error t-value	0.161186 0.08019 2.010048	0.18201 0.084792 2.146539
ΔER_{t-3} Standard Error t-value		0.064252 0.085395 0.752413
ΔER_{t-4} Standard Error t-value		-0.094747 0.085582 -1.107083
ΔER_{t-5} Standard Error t-value		0.129989 0.085705 1.516781
ΔER_{t-6} Standard Error t-value		0.096573 0.084509 1.142752
ΔER_{t-7} Standard Error t-value		-0.080484 0.081552 -0.986936

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.8: Causality between OMR/GBP and Oman Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	9.747781 19.5391 0.49889	-7.28E-05 0.00037 -0.19596
ΔSP_{t-1} Standard Error t-value	0.35667 0.080633 1.423349***	0.287679 0.084583 3.40114***
ΔSP_{t-2} Standard Error t-value	0.355095 0.083239 4.265972	0.416093 0.089068 4.671612
ΔSP_{t-3} Standard Error t-value	-0.109303 0.088955 -1.228808	0.01577 0.096761 0.162983
ΔSP_{t-4} Standard Error t-value		-0.16057 0.09718 -1.652292*
ΔER_{t-1} Standard Error t-value	0.078991 0.080314 0.983527	0.104701 0.084358 1.241147
ΔER_{t-2} Standard Error t-value	0.096479 0.076757 1.256946	0.103749 0.084122 1.233309
ΔER_{t-3} Standard Error t-value		0.068678 0.083857 0.818991
ΔER_{t-4} Standard Error t-value		-0.1506 0.082193 -1.832288
ΔER_{t-5} Standard Error t-value		0.160768 0.083339 1.929084
ΔER_{t-6} Standard Error t-value		0.115907 0.079744 1.453502
ΔER_{t-7} Standard Error t-value		0.009253 0.076876 0.120326

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.9: Causality between QAR/GBP and Qatar Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	39.53891 42.8499 0.92273	0.000158 0.00400 0.03956
ΔSP_{t-1} Standard Error t-value	0.232856 0.079099 2.943854***	0.304232 0.08316 3.658398***
ΔSP_{t-2} Standard Error t-value	-0.156276 0.079807 -1.958183	-0.256917 0.086704 -2.963160
ΔSP_{t-3} Standard Error t-value	0.174966 0.08153 2.146037	0.276504 0.090047 3.070668
ΔSP_{t-4} Standard Error t-value		
ΔER_{t-1} Standard Error t-value	0.197125 0.080183 2.458427	0.197722 0.083538 2.366864
ΔER_{t-2} Standard Error t-value	0.144719 0.079162 1.828138	0.150713 0.084855 1.776131
ΔER_{t-3} Standard Error t-value		0.074347 0.085483 0.869728
ΔER_{t-4} Standard Error t-value		-0.076821 0.084970 -0.904104
ΔER_{t-5} Standard Error t-value		0.174406 0.086536 2.015414
ΔER_{t-6} Standard Error t-value		0.012782 0.085951 0.148713
ΔER_{t-7} Standard Error t-value		-0.000714 0.081475 -0.008761

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.10: Causality between AED/GBP and UAE Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C	0.000482	0.000519
Standard Error	0.00380	0.00385
t-value	0.12673	0.13478
ΔSP_{t-1}	0.195864	0.250195
Standard Error	0.08198	0.08662
t-value	2.391493	2.888402***
ΔSP_{t-2}	0.077819	0.026562
Standard Error	0.083096	0.088833
t-value	0.936502	0.299007
ΔSP_{t-3}	-0.06684	-0.070113
Standard Error	0.082778	0.087808
t-value	-0.806975	-0.79848
ΔSP_{t-4}		0.031228
Standard Error		0.086812
t-value		0.359719
ΔER_{t-1}	0.255888	0.289352
Standard Error	0.081874	0.08723
t-value	3.125385	3.317107
ΔER_{t-2}	0.16472	0.171526
Standard Error	0.080946	0.089527
t-value	2.034936	1.915913
ΔER_{t-3}		0.04991
Standard Error		0.088778
t-value		0.562192
ΔER_{t-4}		-0.122078
Standard Error		0.087677
t-value		-1.392371
ΔER_{t-5}		0.178078
Standard Error		0.089463
t-value		1.990517
ΔER_{t-6}		0.064405
Standard Error		0.089683
t-value		0.718137
ΔER_{t-7}		-0.054068
Standard Error		0.085741
t-value		-0.630602

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

The findings presented in Tables 3.5–3.10 vary according to the market. For instance, it is noticeable that exchange rates cause stock prices for all GCC countries, while stock prices cause exchange rates only in Kuwait and Oman. That is, there is only unidirectional causality between stock prices and exchange rates. The empirical results of the Granger causality test between stock prices and exchange rates (in terms of JPY) are reported in Tables 3.11–3.16. The results show that bidirectional causality exists between stock prices and exchange rates in the case of Oman. In addition, exchange rates cause stock prices in the case of Kuwait—that is, only unidirectional causality is detected between exchange rates and stock prices.

Table 3.11: Causality between KWD/JPY and Kuwait Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	5.28E-05 (9.8E-05) [0.53992]	4.767954 (1.18868) [4.01115]
ΔSP_{t-1} Standard Error t-value	-0.367425 (0.16136) [-2.27698]	-0.6414756 (0.196203) [-0.32695]*
ΔSP_{t-2} Standard Error t-value	1.327657 (0.16066) [8.26365]	-0.3283157 (1.953487) [-0.16807]
ΔSP_{t-3} Standard Error t-value		-0.457872 (0.15652) [-2.92539]
ΔSP_{t-4} Standard Error t-value		1.214697 (0.15934) [7.62346]
ΔER_{t-1} Standard Error t-value	-0.2013685 (0.028023) [-0.71858]	0.921561 (0.25236) [3.65181]
ΔER_{t-2} Standard Error t-value	-0.3461329 (0.2814872) [-0.12297]	0.019620 (0.25349) [0.07740]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.11: Continued

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
ΔER_{t-3} Standard Error t-value	0.716843 (0.22691) [3.15921]	-1.88E-09 (2.0E-08) [-0.09211]
ΔER_{t-4} Standard Error t-value	5.28E-05 (9.8E-05) [0.53992]	2.58E-08 (2.0E-08) [1.28371]
ΔER_{t-5} Standard Error t-value		-2.29E-05 (0.00015) [-0.15048]
ΔER_{t-6} Standard Error t-value		-0.305622 (0.22287) [-1.37127]
ΔER_{t-7} Standard Error t-value		0.716843 (0.22691) [3.15921]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.12: Causality between SAR/JPY and Saudi Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	36.77025 (57.8174) [0.63597]	-4.89E-09 (5.5E-09) [-0.88474]
ΔSP_{t-1} Standard Error t-value	-0.024197 (0.01568) [-1.54332]	-3.69E-08 (2.9E-08) [-1.25360]
ΔSP_{t-2} Standard Error t-value	0.016814 (0.08341) [0.20158]	-2.69E-08 (3.0E-08) [-0.91058]
ΔSP_{t-3} Standard Error t-value		0.007456 (0.08188) [0.09106]
ΔSP_{t-4} Standard Error t-value		0.033673 (0.08666) [0.38857]
ΔER_{t-1} Standard Error t-value	-0.0853253 (0.0234120) [-0.03645]	0.035290 (0.08686) [0.40631]
ΔER_{t-2} Standard Error t-value	0.2013063 (0.238157) [0.84527]	0.012486 (0.08446) [0.14784]
ΔER_{t-3} Standard Error t-value	-302040.5 (238300.) [-1.26748]	-0.000162 (0.00014) [-1.16729]
ΔER_{t-4} Standard Error t-value		0.023265 (0.08420) [0.27631]
ΔER_{t-5} Standard Error t-value		-0.057090 (0.08472) [-0.67388]
ΔER_{t-6} Standard Error t-value		0.012486 (0.08446) [0.14784]
ΔER_{t-7} Standard Error t-value		-0.018250 (0.08328) [-0.21913]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.13: Causality between BHD/JPY and Bahrain Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	0.130691 (11.2594) [0.01161]	-0.031977 (0.01740) [-1.83785]
ΔSP_{t-1} Standard Error t-value	-0.514757 (0.455765) [-1.12944]	0.069744 (0.08117) [0.85925]
ΔSP_{t-2} Standard Error t-value	5.503609 (1.448345) [0.12275]	0.020995 (0.08251) [0.25444]
ΔSP_{t-3} Standard Error t-value		5.44E-09 (3.1E-09) [1.72586]
ΔSP_{t-4} Standard Error t-value		-1.43E-08 (1.5E-08) [-0.98460]
ΔER_{t-1} Standard Error t-value	0.125134 (0.505398) [2.47595]	-0.000162 (9.8E-05) [-1.65344]
ΔER_{t-2} Standard Error t-value	0.910137 (0.435751) [0.20886]	0.067713 (0.08436) [0.80265]
ΔER_{t-3} Standard Error t-value	-4.057886 (4.467720) [-0.90827]	0.009255 (0.08650) [0.10700]
ΔER_{t-4} Standard Error t-value		-0.001235 (0.08640) [-0.01429]
ΔER_{t-5} Standard Error t-value		0.068466 (0.08694) [0.78753]
ΔER_{t-6} Standard Error t-value		-0.004730 (0.08712) [-0.05430]
ΔER_{t-7} Standard Error t-value		-0.013042 (0.08635) [-0.15104]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.14: Causality between OMR/JPY and Oman Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	-0.037605 (0.01586) [-2.37140]	3.48E-09 (1.1E-09) [3.04372]
ΔSP_{t-1} Standard Error t-value	0.313088 (0.08924) [3.50840]	-1.49E-08 (6.4E-09) [-2.31720]
ΔSP_{t-2} Standard Error t-value	0.099244 (0.08921) [1.11242]*	-5.28E-09 (6.4E-09) [-0.82166]
ΔSP_{t-3} Standard Error t-value		-0.004875 (0.08133) [-0.05995]
ΔSP_{t-4} Standard Error t-value		-0.021364 (0.08285) [-0.25786]
ΔER_{t-1} Standard Error t-value	0.550672 (0.08701) [6.32914]	-0.034960 (0.09769) [-0.35787]
ΔER_{t-2} Standard Error t-value	0.246060 (0.09041) [2.72170]	-0.154688 (0.09834) [-1.57300]
ΔER_{t-3} Standard Error t-value		-0.181476 (0.09069) [-2.00101]
ΔER_{t-4} Standard Error t-value		0.082297 (0.08722) [0.94360]
ΔER_{t-5} Standard Error t-value		-2.300071 (31.0742) [-0.07402]*
ΔER_{t-6} Standard Error t-value		0.055102 (0.08547) [0.64469]
ΔER_{t-7} Standard Error t-value		0.056374 (0.08558) [0.65870]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.15: Causality between QAR/JPY and Qatar Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	92.97477 (56.0414) [1.65904]	7.02E-05 (2.2E-05) [3.16410]
ΔSP_{t-1} Standard Error t-value	0.163994 (0.07894) [2.07750]	0.082804 (0.08277) [1.00043]*
ΔSP_{t-2} Standard Error t-value	-0.062781 (0.08072) [-0.77775]	0.021193 (0.08292) [0.25557]
ΔSP_{t-3} Standard Error t-value		0.093090 (0.08100) [1.14932]
ΔSP_{t-4} Standard Error t-value		-5.05E-08 (3.1E-08) [-1.61537]
ΔER_{t-1} Standard Error t-value	0.125032 (0.08408) [1.48704]	-0.002375 (0.00410) [-0.57923]
ΔER_{t-2} Standard Error t-value	-0.071693 (0.08397) [-0.85382]	0.076772 (0.08503) [0.90288]
ΔER_{t-3} Standard Error t-value		0.003278 (0.08698) [0.03768]
ΔER_{t-4} Standard Error t-value		0.069323 (0.08590) [0.80706]
ΔER_{t-5} Standard Error t-value		-0.015465 (0.08604) [-0.17974]
ΔER_{t-6} Standard Error t-value		0.123204 (0.08533) [1.44386]
ΔER_{t-7} Standard Error t-value		0.165460 (0.08416) [1.96613]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

Table 3.16: Causality between AED/JPY and UAE Stock Prices

	Stock Price Cause Exchange Rate $\Delta SP_t \rightarrow \Delta ER_t$	Exchange Rate Cause Stock Price $\Delta ER_t \rightarrow \Delta SP_t$
Optimal Lags Length	$n_1 = 3$ and $n_2 = 2$ Dependent Variable ΔSP	$n_1 = 7$ and $n_2 = 4$ Dependent Variable ΔER
C Standard Error t-value	27.16355 (24.4232) [1.11220]	7.00E-05 (2.1E-05) [3.37247]
ΔSP_{t-1} Standard Error t-value	-0.006813 (0.08051) [-0.08463]	-0.038392 (0.01787) [-2.14852]
ΔSP_{t-2} Standard Error t-value	0.103161 (0.08126) [1.26955]	0.175902 (0.07986) [2.20259]
ΔSP_{t-3} Standard Error t-value		0.103161 (0.08126) [1.26955]
ΔSP_{t-4} Standard Error t-value		0.148738 (0.08078) [1.84136]
ΔER_{t-1} Standard Error t-value	-0.015916 (0.08370) [-0.19015]	-0.000243 (0.00128) [-0.19004]
ΔER_{t-2} Standard Error t-value	0.102833 (0.08369) [1.22870]	0.154604 (0.08458) [1.82781]
ΔER_{t-3} Standard Error t-value		0.031311 (0.08598) [0.36416]
ΔER_{t-4} Standard Error t-value		0.009312 (0.08502) [0.10953]
ΔER_{t-5} Standard Error t-value		0.036459 (0.08486) [0.42963]
ΔER_{t-6} Standard Error t-value		-0.057951 (0.08518) [-0.68033]
ΔER_{t-7} Standard Error t-value		0.101481 (0.08471) [1.19803]

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively.

3.8 Conclusion

In this chapter, we estimated the relationship between exchange rates and stock prices in GCC countries during the period 2000–2013. The empirical results show that there is cointegration between stock prices and exchange rates in Kuwait, Bahrain and Oman. The Granger causality test reveals that exchange rates (in terms of GBP) cause stock prices in all GCC countries, while stock prices cause exchange rates in Oman and Kuwait. In contrast, the empirical evidence indicates that exchange rates (in terms of JPY) cause stock prices in Kuwait, while there is only one case of bidirectional causality between stock prices and exchange rates (in the case of Oman).

Chapter 4: Exchange Rate Forecasting and the Meese–Rogoff Puzzle

4.1 Introduction

The study conducted by Meese and Rogoff (1983a) found that the random walk model cannot be outperformed by exchange rate models in terms of the magnitude of error in an out-of-sample forecasting exercise. The findings stimulated important research in the area, and many attempts have been made to overturn the findings using a variety of samples, periods, data, model specifications and methodologies. However, many of these attempts have either been fraudulent or unsuccessful in their claims of success. Economists now widely believe that the random walk model cannot outperform exchange rate models, and that exchange rate models have little to no explanatory power. This is commonly known as the Meese–Rogoff puzzle.

While exchange rate forecasting is not an easy task, it is inventible for financial decision making in this era of globalisation. The importance of forecasting stems from the fact that the outcome of a financial decision made today is contingent upon the value of the underlying exchange rate that will prevail in the future. Thus, exchange rate forecasting is needed for a variety of international financial operations, such as capital budgeting, speculation and hedging (Moosa 2003).

In this chapter, in-sample forecasts for a variety of exchange rates are generated using the flexible-price monetary model and naïve random walk model, which is one of the models used by Meese and Rogoff (1983a). The accuracy of the forecasts generated by these models is assessed using the conventional methodology applied by Meese and Rogoff. Conversely, another objective of this chapter is to test and specify a forecasting model of the exchange rate for the GCC countries (Kuwait, Saudi Arabia, Bahrain, Oman, Qatar and the UAE). All of these countries peg their currencies to the US dollar, except Kuwait; which pegs to a basket of currencies.

The next section presents a review of the literature, while Section 4.3 describes the data. Section 4.4 explains the methodology and Section 4.5 presents the empirical results. Finally, the chapter will conclude with a discussion.

4.2 Literature Review

The literature review deals with three issues: (i) forecasting financial prices and the Meese–Rogoff puzzle; (ii) the random walk model; and (iii) the flexible-price monetary model.

4.2.1 Forecasting Accuracy and the Meese–Rogoff Puzzle

The Meese–Rogoff puzzle is the proposition put forward by Meese and Rogoff (1983a), who suggested that exchange rate determination models cannot be superior to the naïve random walk model, which means that the best forecast for the exchange rate is today’s level, or that the expected change is zero. This proposition is equally applicable to stock prices and financial prices in general. If this is the case, then forecasting-based trading is unlikely to be more profitable than trading on the assumption of zero change. Using a number of multivariate exchange rate series models, Hlouskova and Wagner (2004) compared the predictive ability of the random walk model with that of alternative exchange rate models. Their findings showed that linear multivariate models present superior predicting properties than the random walk model in the short term. Taylor and Allen (1992) analysed exchange rate models and found them to be superior to the naïve random walk model. A study conducted by Swamy and Schinasi (1989) demonstrated that broader models can be superior to the random walk model in terms of out-of-sample predicting ability. Moreover, Chen and Wu (2001) provided evidence against Meese and Rogoff's results by analysing other time-varying parameter models. Their findings showed that these models cannot only beat the naïve random walk model, but that the forecasts are also significantly superior to those generated by the random walk model.

Believing that this is a puzzle, economists have put forward several explanations for Meese and Rogoff's finding. Meese and Rogoff explained the puzzle in terms of econometric problems such as simultaneous equation bias, sampling errors, stochastic movements in the true underlying parameters, model misspecification, failure to account for nonlinearities, and the proxies used for inflationary expectations. Many economists have supported the model-inadequacy proposition that structural exchange rate models do not provide a valid representation of exchange rate behaviour in practice (e.g., Cheung and Chinn 1998). Many more explanations have been suggested to resolve the puzzle, as will be discussed later.

The main reason underpinning, and the root cause of, the Meese–Rogoff puzzle has been overlooked in the literature. Assessing forecasting accuracy exclusively by the magnitude of the forecasting error (as Meese and Rogoff did) may explain why the random walk model cannot be outperformed. In fact, the exchange rate models should produce smaller forecasting errors than the random walk model (Moosa 2013). It has been demonstrated that other explanations for the puzzle, such as those suggested by Meese and Rogoff themselves, cannot explain the puzzle (e.g., Moosa and Burns 2014).

4.2.2 Random Walk Model

The concept of 'random walk' was first described by Pesaran etc. (1999). He argued that future stock price movements cannot be predicted by their past movements or trends, which means that the price at time *t* will be the price at time *t*+1 plus a noise term ε. In this chapter, all of the models described later will be compared with the random walk model with respect to their forecasting ability.

Throughout the history of exchange rate forecasting models, no model has performed as well as the random walk model. According to Meese and Rogoff (1983a), these models did not perform better than the random walk model despite the fact that they used realised values as explanatory variables. This means that one is better off flipping a coin than using one of the models to forecast exchange rate movements.

Kilian and Taylor (2003) noted why the naïve random walk model is so hard to beat. They argued that the concept of linear forecasting models is wrong; thus, they fail in their predictive ability due to non-linearity in the data. Linking exchange rates with underlying fundamentals (e.g., relative prices) does not work in the short term, but only over longer horizons, which is why they switched to longer horizons of two to three years. However, forecasting over two to three years is quite general and therefore provides little incentive to implement it for short-term forecasts. Investors are not prepared to wait for a general forecasting model with an excessively long horizon.

4.2.3 Flexible-price Monetary Model

One of the most important models used to forecast exchange rates is the flexible-price monetary model, which explains movements in the exchange rate in terms of industrial production, money supply and interest rates, assuming that non-monetary assets are perfect substitutes. Frenkel (1976) formulated the flexible-price monetary model by assuming that prices adjust immediately in the money market. This means that domestic capital is a perfect substitute for foreign capital, as the yields are the same. Dornbusch (1976) had a different view on this topic, as he assumed that prices adjust gradually. This means that the purchasing power parity would only hold in the long run; thus, domestic and foreign capital is not perfect substitutes. According to MacDonald and Taylor (1992), the flexible-price monetary model performs poorly in terms of explaining and predicting exchange rates. Li (2011) observed a better performance for the purchasing power parity model compared to the flexible-price monetary model. Chen and Mark (1996) had similar results.

4.3 Model Specifications

This section describes three models: the random walk model, the flexible-price monetary model and the basket currency model.

4.3.1 Random Walk Model

A data series is said to follow a random walk if the change from one period t to the next $t+1$ is unpredictable because it is purely random (Copeland and Wang 2000). The random walk model means that agents with rational expectations forecast neither appreciation nor depreciation between the current and previous period's exchange rate (i.e., the naïve random walk model predicts no change from one period to another). This proposition is consistent with weak-form efficiency in the foreign exchange market (Moosa 2000). The naïve random walk model is represented as follows:

$$E_t = \alpha + E_{t-1} + \varepsilon_t \tag{4.1}$$

where ε_t is completely random and displays no pattern over time. The random walk model contains no economic content because it cannot describe or explain exchange rate movements. Being a univariate time series model, the underlying rationale is that the effect of macro variables on the exchange rate is 'embodied in, and reflected by, the actual behaviour of the exchange rate' (Moosa and Korczak 2000).

4.3.2 Flexible-price Monetary Model

This section focuses on the flexible-price monetary model, which has been the dominant exchange rate model since the 1970s and 'remains an important exchange rate paradigm' (Neely and Sarno 2002).

Meese and Rogoff (1983a) used the random walk model as a benchmark to assess the forecasting power of the Frenkel–Bilson flexible-price monetary model, the Dornbusch–Frankel sticky-price monetary model and the sticky-price monetary model incorporating current account effects as formulated by Hooper and Morton. This study only focuses on the Frenkel–Bilson flexible-price monetary model. This model is used to generate forecasts for the dollar against the other two major currencies (GBP and JPY), and then for the GCC currencies (five of which are pegged to the dollar), by calculating the forecast cross-rates. The flexible-price monetary model is specified as follows:

$$e_t = \alpha_0 + \alpha_1(m_t - m_t^*) + \alpha_2(y_t - y_t^*) + \alpha_3(i_t - i_t^*) + \varepsilon_t \tag{4.2}$$

where lower-case letters imply the logarithms of the underlying variables (except for the interest rate) and a star denotes the corresponding foreign variable. The cross-rates between non-dollar currencies and GCC currencies are calculated accordingly. As the Kuwaiti currency is pegged to a basket, forecasts for the KWD/USD exchange rate are generated from the basket equation, while other forecasts are calculated as cross-rates.

4.3.3 Currency Basket Model

Since 1975, the Central Bank of Kuwait has adopted an exchange rate arrangement whereby its currency (KD) is pegged to a basket of currencies with unknown components (Moosa 2002). Given this arrangement, the exchange rate of the KD against the USD is calculated from the exchange rates of the currencies included in the basket. This can be represented formally by the following equation:

$$E_0 = \alpha_0 + \sum_{t=i}^{n} \alpha_i E_i \tag{4.3}$$

where E_0 is the KD/USD exchange rate and E_i is the exchange rate of currency i against the USD, such that $i = 1,2,3, \dots \dots , n$ and n is the number of the non-dollar currency included in the basket. Consequently, α_0 is represented by the weight assigned to the dollar in the basket, while α_i is represented by the weight assigned to the currency i. The exchange rate of the KD against currency *i* is measured as a cross-rate, as follows:

$$\hat{E}_k = \frac{E_0}{E_i} \tag{4.4}$$

which gives:

$$\hat{E}_k = \frac{\alpha_0 + \sum_{i=1}^{n} \alpha_i E_i}{E_k} \tag{4.5}$$

Thus, $\grave{E}_k$would be expected to fall (rise) if E_i is expected to fall (rise) and/or E_k is expected to rise (fall).

4.4 Forecast Evaluation Criteria

Drawing from the existing literature, several measures of forecasting accuracy are used to assess and compare the accuracy of the forecasts. This section presents the measures of forecasting accuracy.

4.4.1 Forecast Errors

The forecast error is the difference between the actual value and the predicted value. It is calculated as follows:

$$w_t = E_{0,t} - \hat{E}_{0,t} \tag{4.6}$$

where $\hat{E}_{0,t}$ is the predicted exchange rate. By using the forecast error series, the following measures of predictive values are calculated.

4.4.2 Mean Absolute Error

The mean absolute error (MAE) is calculated as the average magnitude of the error series in a set of forecasts. It should be noted that the MAE cannot be used to assess the accuracy of predicting the direction of change. The MAE measure is defined as:

$$MAE = \frac{1}{n}\sum_{t=1}^{n}|w_t| \tag{4.7}$$

where *n* is the number of point forecasts.

4.4.3 Mean Square Error

The mean square error (MSE) is the most commonly used measure of forecasting accuracy. It can be defined as:

$$MSE = \frac{1}{n}\sum_{i=t}^{n}(w_t)^2 \tag{4.8}$$

The MSE is also known as the mean squared deviation.

4.4.4 Root Mean Square Error

The root mean square error (RMSE) or root mean square deviation (RMSD) is used to measure the difference between the values predicted by the the model and the actual values. It is calculated as:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(w_t)^2} \tag{4.9}$$

The RMSE of the random walk model is calculated as:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(E_{t-1} - E_t)^2} \tag{4.10}$$

The RMSE is important for measuring the standard deviation to sample of forecast errors. If the ratio of the RMSE flexible-price monetary model to the RMSE of the random walk model is smaller than 1, the flexible-price monetary model is better than the random walk model. If the ratio is greater than 1, the random walk model is superior.

4.4.5 Theil's Inequality Coefficient

Theil's inequality coefficient (U) is a measure of the predictive power relative to that of a random walk model. Theil's U is an indicator of how well a time series of estimated values compares to a corresponding technique of time series of observed values. Theil's U is calculated as:

$$Thiel's\ U = \frac{\sqrt{\frac{1}{n-1}\sum_{t=1}^{n}\left(w_{t+1}^{2}\right)^{2}}}{\sqrt{\frac{1}{n-1}\sum_{t=1}^{n}\left(\Delta E_{0,t+1}\right)^{2}}} \tag{4.11}$$

If $Thiel's\,U$ is greater than 1, the flexible-price monetary model is worse than the random walk model in forecasting, and vice versa.

4.4.6 Direction Accuracy and the Confusion Rate

Direction accuracy (DA) and the confusion rate (CR) are measures of the ability of a model to predict the direction of change. For some financial decision-making situations, predicting the direction change is more important than producing the magnitude of the error—that is, predicting the direction of change is more important than predicting the magnitude of the error (e.g., Mossa and Al-Abudlijader 2006). Direction accuracy is measured as:

$$DA = \frac{1}{n-1}\sum_{t=1}^{n} a_{t+1} \tag{4.12}$$

where $a_{t+1} = 1, if\ (E_{0,t+1} - E_{0,i})\ (\hat{E}_{0,t+1} - E_{0,t}) > 0$ and $a_t = 0$ otherwise. Thus, a takes the value of 1 if the predicted and actual changes have the same sign, and if a = 0, the predicted and actual changes have opposite signs. If $(E_{0,t+1} - E_{0,t})(\hat{E}_{0,t+1} - E_{0,t}) > 0$ for all t, the value of the DA will be 1, implying that the model predicts the change correctly on all occasions. In this case, the CR is 0. In general, the CR is related to the measure of DA, as follows:

$$CR = 1 - \frac{1}{n-1}\sum_{t=1}^{n} a_{t+1} \tag{4.13}$$

or:

$$CR = 1 - DA \tag{4.14}$$

4.4.7 Correlation between Actual Change and Predicted Change

The correlation between actual change and predicted change is a measure of the strength and direction of the linear relationship between predicted and actual variables. This measure is calculated as:

$$R = \frac{Cov(E_t, \hat{E}_t)}{\sqrt{Var(E_t)Var(\hat{E}_t)}} \tag{4.15}$$

4.4.8 Ashely, Granger and Schmalenise Test

To formally test the predictive accuracy of the flexible-price monetary model against that of the random walk model, the Ashely, Granger and Schmalenise (1980) test (AGS) is used. The AGS test requires the estimation of linear regression:

$$D_t = \gamma_0 + \gamma_1(M_t - \bar{M}) + \mu_t \tag{4.16}$$

where $D_t = w_{1t} - w_{2t}$, and $M_t = w_{1t} + w_{2t}$. $\bar{M}$ is the mean of M, w_{1t} is the forecasting errors series at time t of the model with the numerically higher RMSE, and w_{2t} is the forecasting errors series at time t of the model with the numerically lower RMSE. If the sample mean of the forecasting error is negative, the observations must be multiplied by -1 prior to running the regression.

The estimates of the intercept γ_0 and slope γ_1 from Equation (4.16) are required to test the statistical difference between the RMSEs of two different models (random walk and flexible-price monetary model). The null hypothesis is that the two RMSEs are equal. If the estimates of the intercept γ_0 and slope γ_1 are both positive, the Wald test of joint hypothesis $H_0 : \gamma_0 = \gamma_1 = 0$ is appropriate. The test statistic follows a chi-squared distribution, with two degrees of freedom. Nonetheless, if one of the estimates is negative but statistically significant, the test statistic is inconclusive. If one of the coefficient estimates is negative and statistically insignificant, the test remains conclusive and valid. In this case, the significance is determined by the upper tail of the t-test of the positive coefficient estimate.

4.5 Data

The empirical results are based on a sample of monthly data covering the period 1 January 2000 to 31 December 2013. Data on the money supply, interest rates, industrial production and closing spot exchange rates were obtained from Datastream. The empirical work is performed on 13 exchange rates: two against the US dollar (GBP/USD, JPY/USD), 10 cross-rates (SAR/GBP, BHD/GBP, OMR/GBP, QAR/GBP, AED/GBP,

SAR/JPY, BHD/JPY, OMR/JPY, QAR/JPY, AED/JPY) and one exchange rate related to the basket currency (Kuwait currency). Table 4.1 lists the countries, exchange rates and stock market indices.

Table 4.1: List of Countries and Exchange Rates

Country	Currency against GBP	Currency against JPY
Kuwait	KWD/GBP	KWD/JPY
Saudi Arabia	SAR/GBP	SAR/JPY
Bahrain	BHD/GBP	BHD/JPY
Oman	OMR/GBP	OMR/JPY
Qatar	QAR/GBP	QAR/JPY
UAE	AED/GBP	AED/JPY

4.6 Empirical Results

Table 4.2 presents the descriptive statistics for the nine variables under study. The values of kurtosis and skewness suggest a lack of symmetry in the distribution. In general, if the values of kurtosis and skewness are three and zero respectively, the observed distribution can be normal. Moreover, if the coefficient of skewness exceeds unity, it is considered fairly extreme, and the high (low) kurtosis value suggests extreme leptokurtic (platykurtic). As shown in Table 4.2, the distributions of underlying variables are not normal. A significant Jarque–Bera statistic also suggests that the distribution is not normal. The standard deviation values indicate that the KWD/GBP, AED/GBP, JPY/USD and EURO/USD series are relatively more volatile compared to other exchange rates, industrial production, the money supply and interest rates.

Table 4.2: Descriptive Statistic of the Data Series

	Mean	Maximum	Minimum	Std. Dev	Skewness	Kurtosis	Jarque-Bera
Exchange Rates							
KWD/USD	0.2893	0.3082	0.2639	1.14%	-0.0741	-0.6071	10.0064
KWD/GBP	0.4808	0.5794	0.4068	4.29%	0.4804	2.0952	14.8052
KWD/JPY	0.0028	4.8946	4.3386	14.81%	-0.5620	2.1880	13.4591
SAR/USD	3.7485	3.7526	3.7249	0.31%	-4.0405	25.1720	40.6923
SAR/GBP	6.2407	7.1280	4.8251	6.21%	-0.3042	1.9871	9.7722
SAR/JPY	0.0366	0.0489	0.0281	0.56%	0.7549	2.3980	18.4940
BHD/USD	0.3754	0.3770	0.3724	0.13%	-0.4431	2.1058	11.0958
BHD/GBP	0.6250	0.7761	0.5289	6.65%	0.5729	2.1339	14.4422
BHD/JPY	0.0037	0.0049	0.0028	0.06%	0.7621	2.4325	18.5163
OMR/USD	0.6378	0.3850	0.3826	0.05%	0.2894	2.6819	3.0538
OMR/GBP	0.0037	0.7943	0.5572	6.88%	0.3588	2.7123	4.1837
OMR/JPY	0.3840	0.005	0.0029	0.04%	0.1522	1.9258	8.7249
QAR/USD	3.6336	3.6402	3.5648	0.98%	-4.4705	28.9143	52.6047
QAR/GBP	6.0493	7.5133	5.1069	6.46%	0.5608	2.1532	13.8245
QAR/JPY	0.0355	0.0475	0.0275	0.55%	0.7437	2.3839	18.1439
AED/USD	3.6722	3.6729	3.6689	0.06%	-2.6623	15.202	12.4064
AED/GBP	6.1138	7.6038	5.1530	6.541%	0.5721	2.1620	14.0853
AED/JPY	0.0359	0.0427	0.0286	0.0041	0.1403	1.9210	8.69510
GBP/USD	0.6073	0.7128	0.4825	06.21%	-0.3042	1.9871	9.77232
JPY/USD	104.657	133.6054	76.6402	14.86%	-0.3646	2.0663	9.82443
EURO/USD	0.8351	1.1711	0.6336	14.51%	1.0302	2.80734	29.9781
CHE/USD	1.2271	1.2090	1.7842	0.7805	0.2606	0.5664	12.0685
Macroeconomic Variables							
IPI — USA	93.5683	101.5572	88.7320	4.4080	-0.01913	2.0527	6.2922
IPI – UK	106.1030	114.9000	94.2000	6.5889	-0.4942	1.5630	21.4924
IPI — Japan	102.0940	117.3000	76.6000	7.9239	-0.3569	3.48212	5.19466
IN-USA	1.9558	6.3700	0.0100	1.9857	0.7319	2.1602	19.9394
IN-UK	3.4648	6.5307	0.5000	2.0924	-0.28338	1.5003	18.1808
IN-Japan	0.2812	1.0377	0.0475	0.2791	1.3530	3.5839	53.6438
MSI-USA	7357.211	10969.10	4546.500	1770.413	0.3619	2.0604	9.8457
MSI-UK	977.6850	1408.765	551.1050	257.6122	-0.0933	1.7018	12.041
MSI-Japan	725.9689	863.0314	620.4003	62.9067	0.3579	2.1652	8.4643

Note: IPI is industrial production index, MS is money supply (national currency) and IN is interest rate.

4.6.1 Random Walk Model Results

The regressions of all of the forecasting random walk and flexible-price monetary models are compared with their p-values and R^2 coefficients on an in-sample basis. The AGS test is used to determine whether the model performs better than the random walk model. Table 4.3 presents the estimation results for the GBP/USD and JPY/USD rates. Table 4.4

reports the measures of forecasting accuracy for these two rates and all of the possible cross-rates. Figure 4.1 displays the actual and predicted rates, exhibiting a typical feature of the forecasts generated by the random walk model—that is, that the forecasts follow the actual rate. This means that the actuals forecast the forecasts rather than vice versa. Thus, although the random walk model produces small forecasting errors, it is not a good forecaster. In terms of DA, the random walk model without drift has a DA of 0, as it always predicts no change when exchange rates typically change from one period to another. The random walk model with drift, which is present in this case, has a DA of more than 0, as it captures direction correctly on some occasions. This is because the random walk model with drift predicts that the exchange rate always rises or falls, depending on the sign of the drift term.

Table 4.3: Estimated Random Walk Regression

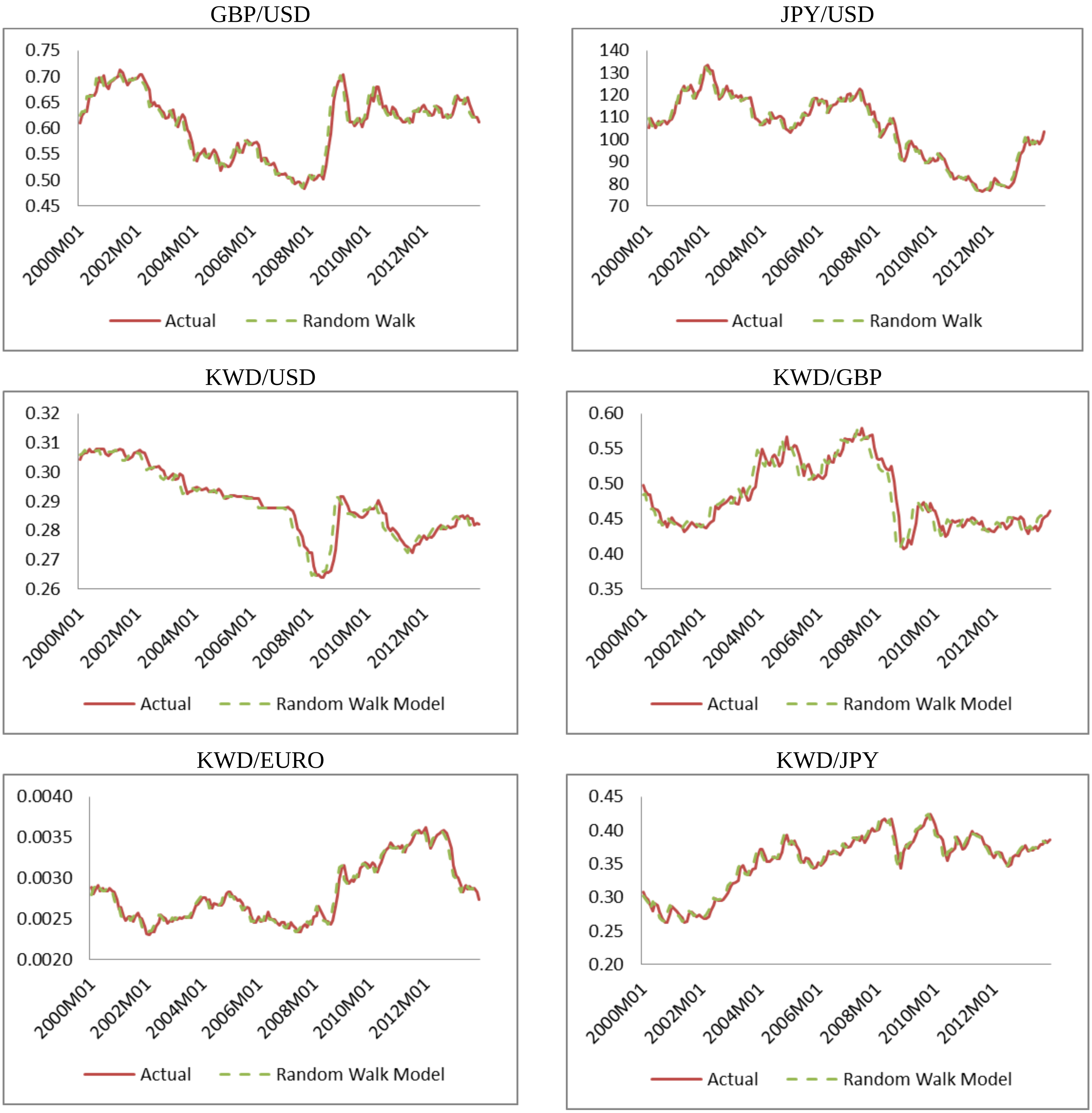
Exchange Rate	α	t-statistic	E_{t-1}	t-statistic	R^2
GBP/USD	0.014157	1.387761	0.976688	58.44330*	0.953919
JPY/USD	1.445121	1.056249	0.986100	76.19241*	0.972363

Note: Significant at the 99 per cent confidence level.

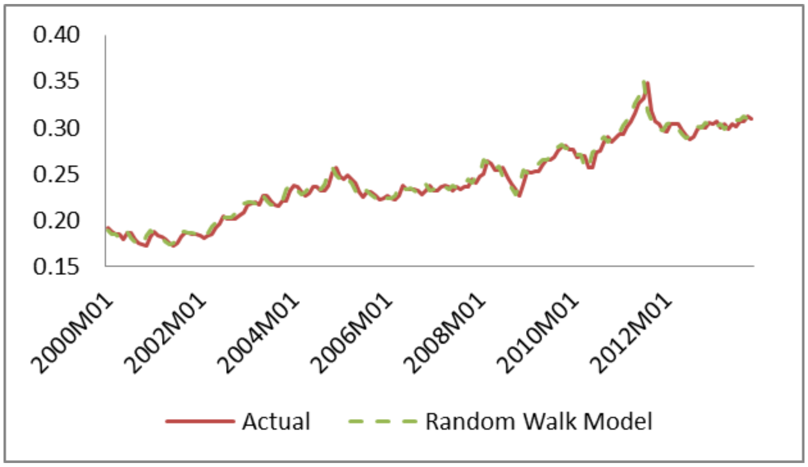
Table 4.4: Forecasting Accuracy of the Random Walk Model

Exchange Rate	MAE	MSE	RMSE
GBP/USD	0.00996	0.00018	0.01329
JPY/USD	0.80461	0.00639	0.07994
KWD/USD	0.00186	0.00047	0.02168
KWD/GBP	0.00371	0.00127	0.03564
KWD/JPY	0.00002	0.01090	0.32981
KWD/EURO	0.00300	0.00089	0.02983
KWD/CHE	0.00273	0.00059	0.02429
SAR/GBP	0.3731	0.224491	0.473804
SAR/JPY	0.000278	0.007802	0.002797
BHD/GBP	0.004888	0.002232	0.047249
BHD/JPY	2.80E-05	0.007610	0.000279
OMR/GBP	0.006488	0.002421	0.049207
OMR/JPY	3.20E-05	8.20E-06	0.000287
QAR/GBP	0.047429	0.021088	0.145217
QAR/JPY	5.90E-05	5.60E-06	7.50E-04
AED/GBP	0.047939	0.0215296	0.14673
AED/JPY	0.000271	7.50E-06	0.002739

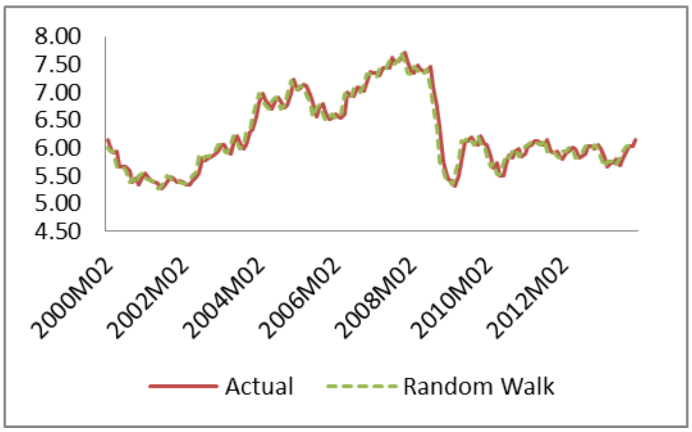
Figure 4.1: Random Walk Model Forecasting Exchange Rates over Sample Period



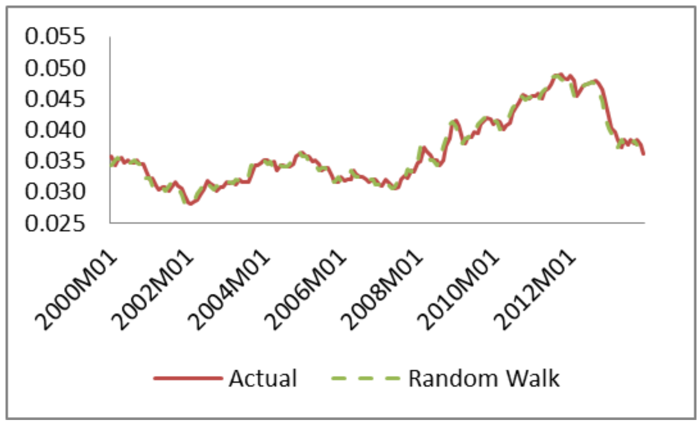
KWD/CHE



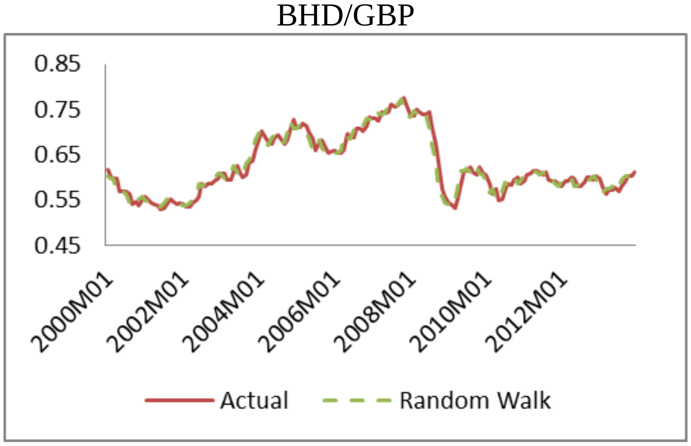
SAR/GBP



SAR/JPY



BHD/GBP



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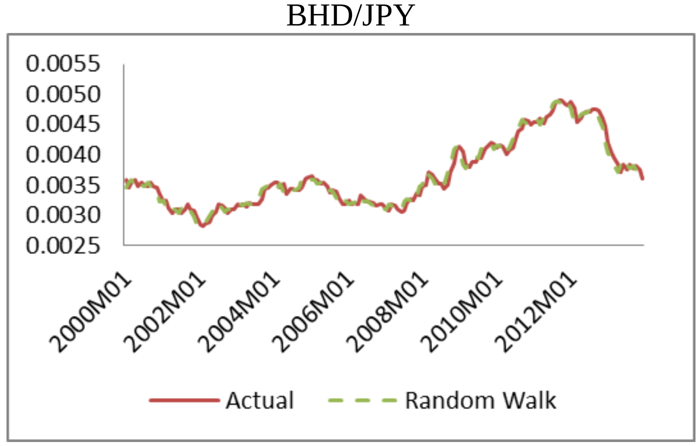
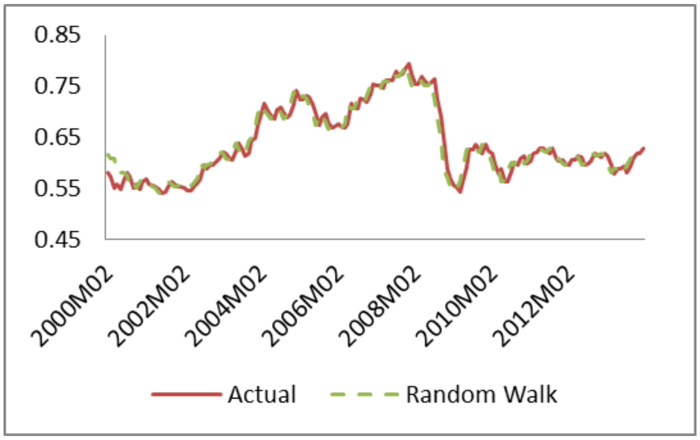


OMR/GBP



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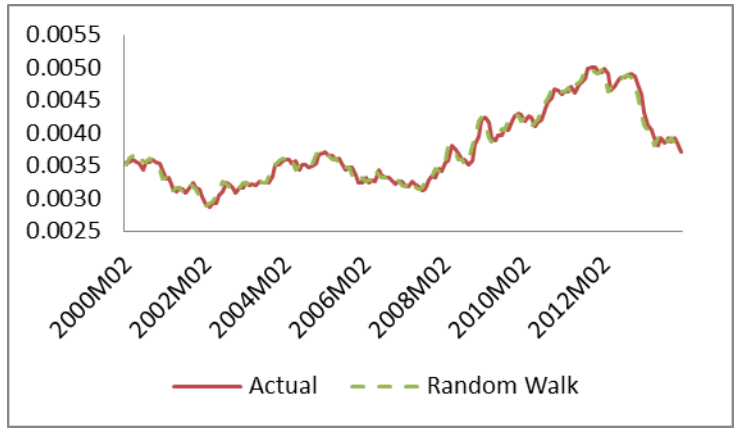
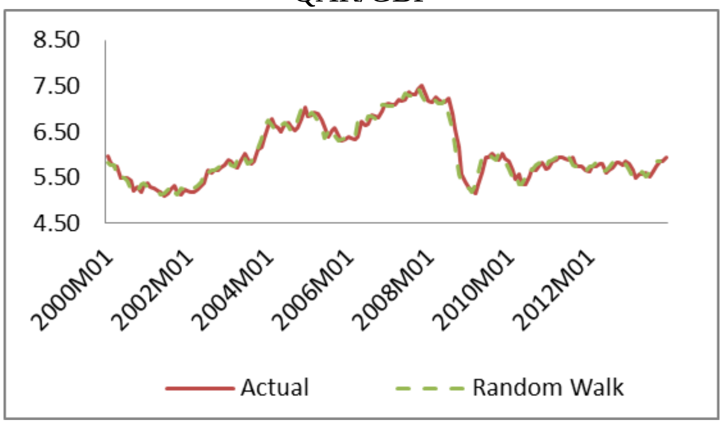
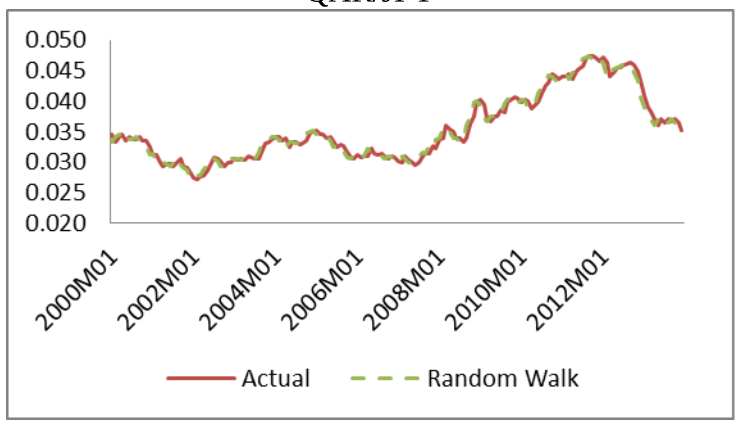


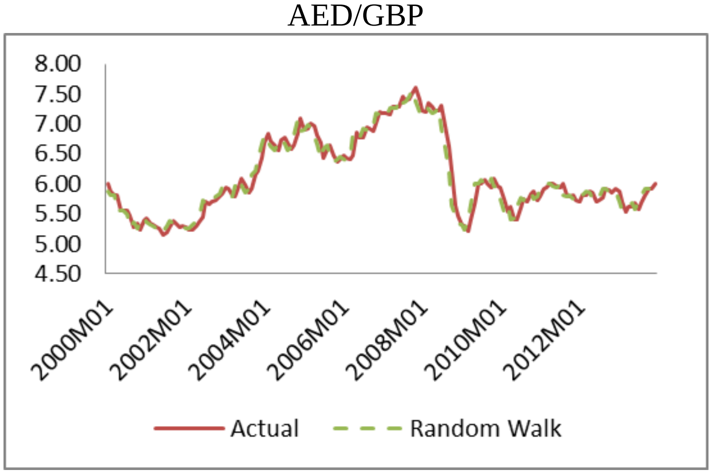
QAR/GBP



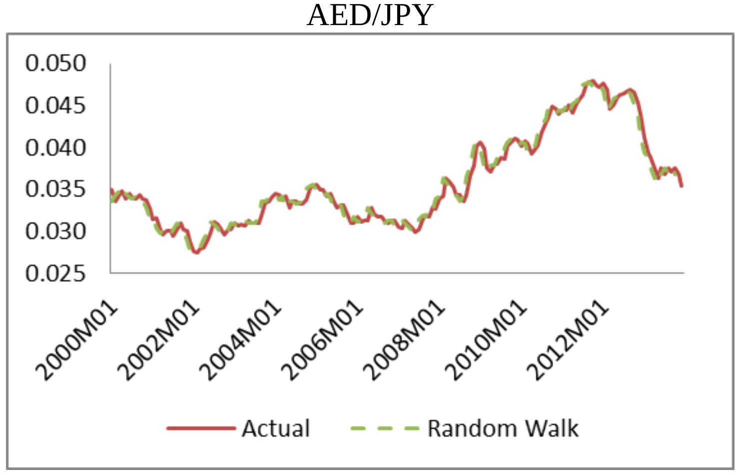
QAR/JPY



AED/GBP



AED/JPY



4.6.2 Flexible-price Monetary Model Results

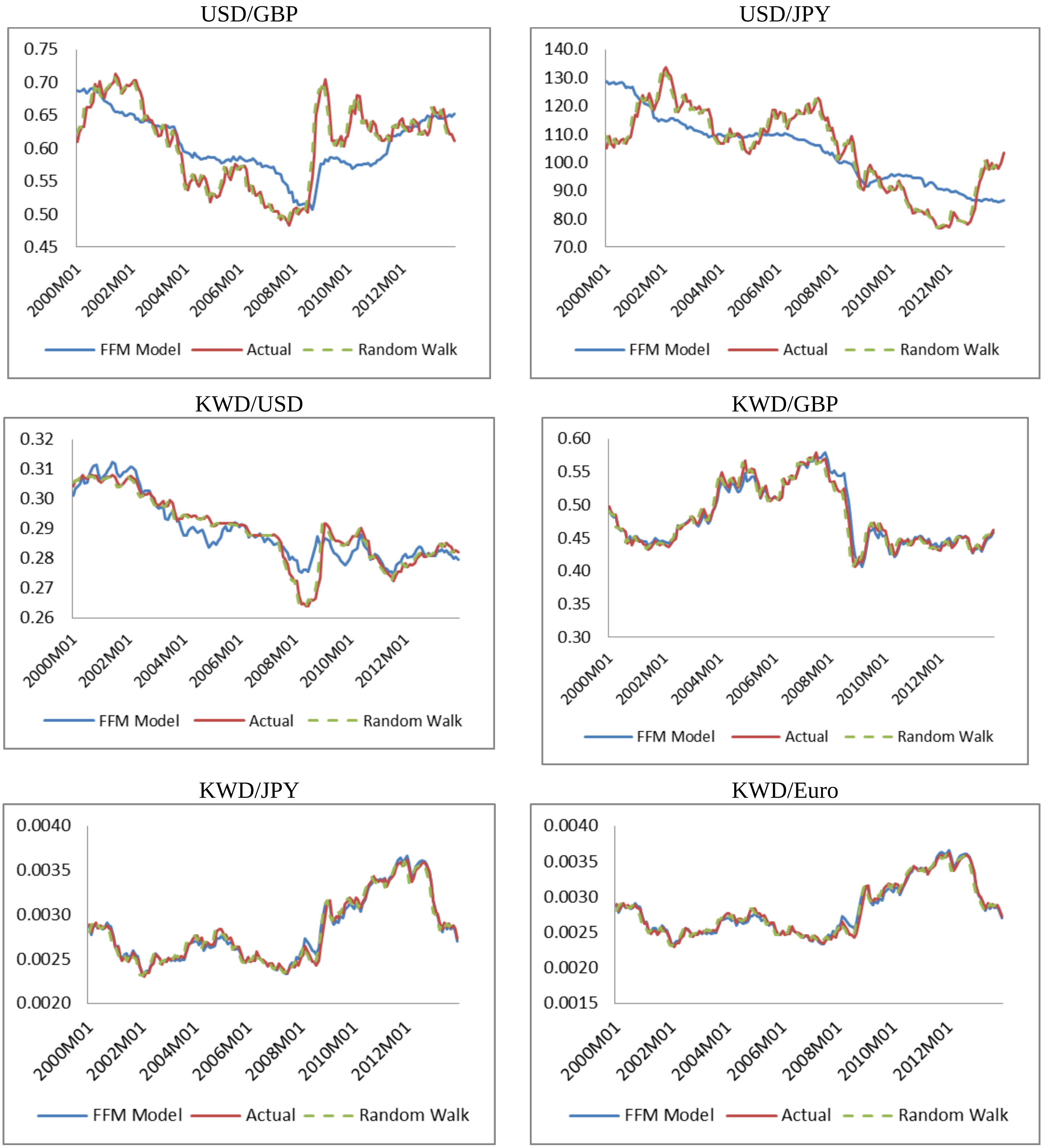
Table 4.5 presents the estimation results of the flexible-price monetary model for the GBP/USD and JPY/USD exchange rates. The estimated models are used to generate in-sample forecasts for the two exchange rates, and the forecasts of the exchange rates of the GCC against GBP and JPY are then calculated as cross-rates. Figure 4.2 present the actual values and forecasts generated by the monetary model and the random walk model. It is shown that the random walk model produces smaller forecasting errors than the monetary model, but this does not make the random walk model a better forecaster, at least for the reason stated earlier—that is, in the random walk, the actuals forecast the forecasts. The random walk model, while more closely aligned to actual observations, cannot predict the turning points in the data; rather, it tracks the actual values (exchange rate) in a lagged manner. Figure 4.3 shows that most of the data points representing combinations of actual and predicted changes fall in the first and third quadrants, implying a high degree of accuracy in predicting the direction of change. Thus, while the random walk model produces smaller forecasting errors, the monetary model outperforms the random walk model in predicting the direction of change. Thus, it follows that one explanation for the Meese–Rogoff puzzle is that they evaluated forecasting power in terms of metrics that only take into account the magnitude of the error.

Table 4.5: Estimated the Flexible-price Monetary Model Regression

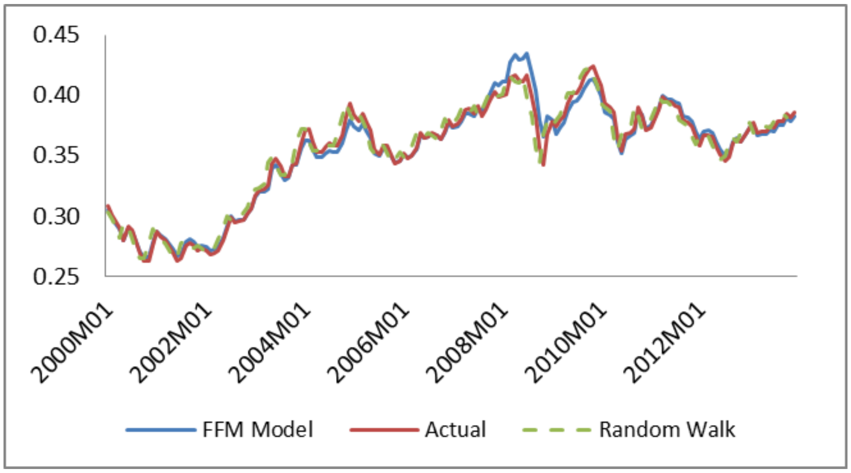
ERs	α_0	α_1	α_2	α_3	R^2
GBP/USD	-2.755956*	0.140709	0.020429*	1.134839*	0.593047
JPY/USD	5.932725*	-0.146739	0.011721*	-0.578269*	0.589855

Note: *, ** and *** are significant at 99 per cent confidence levels.

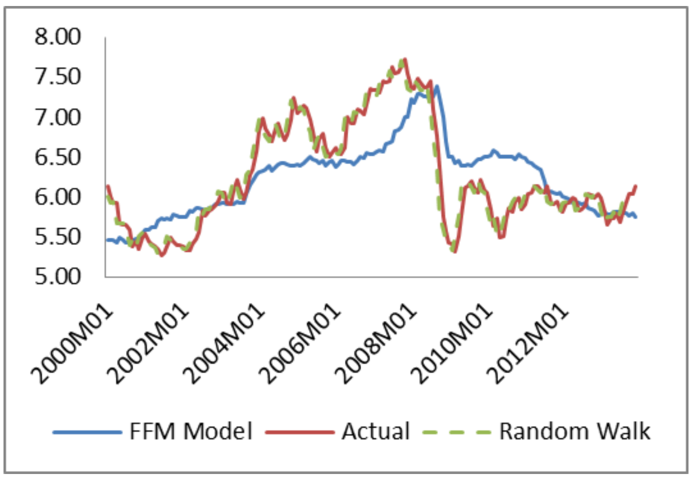
Figure 4.2: Time Series of Forecasting Horizon



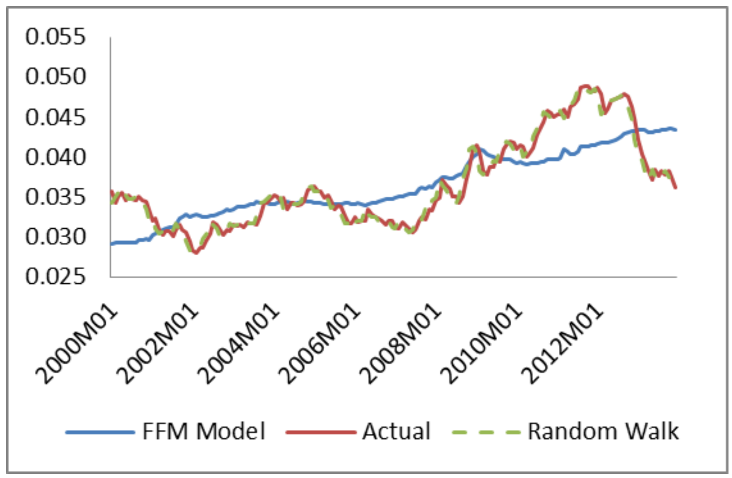
KWD/CHE



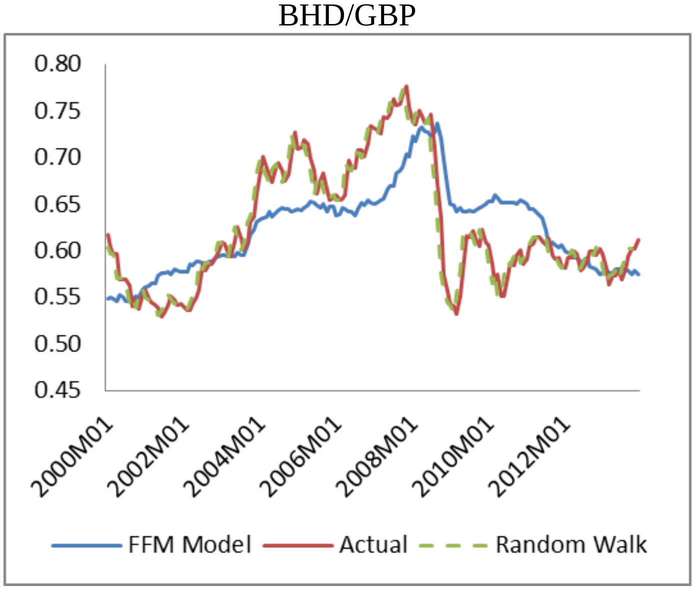
SAR/GBP



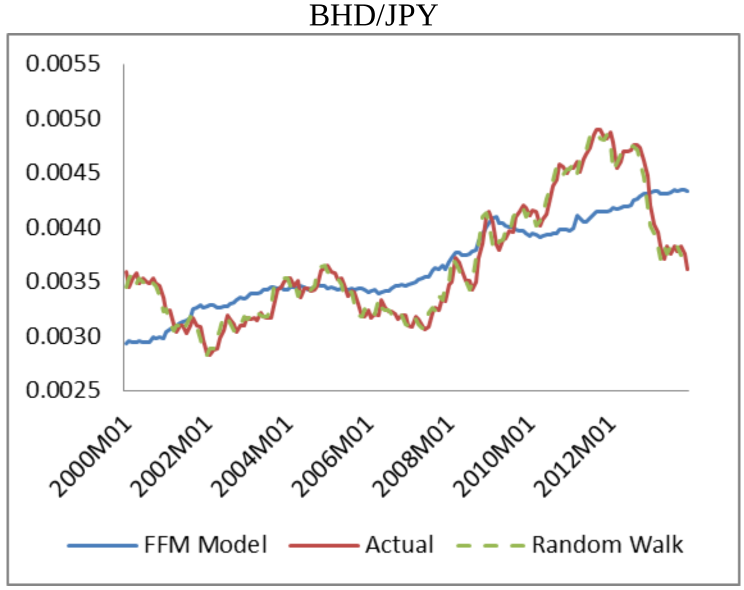
SAR/JPY



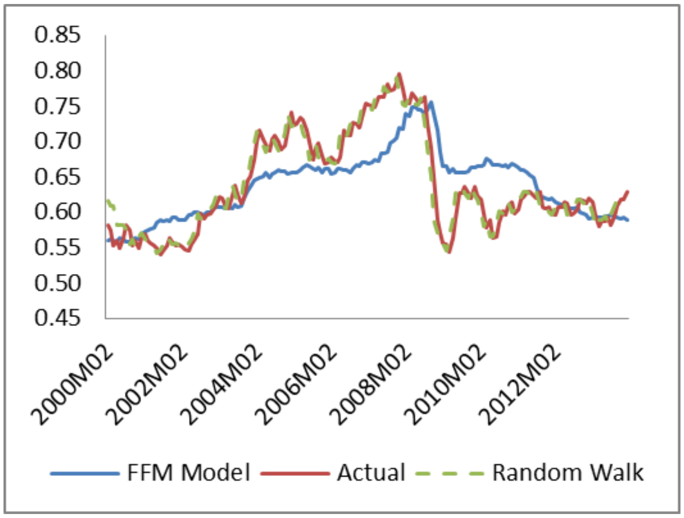
BHD/GBP



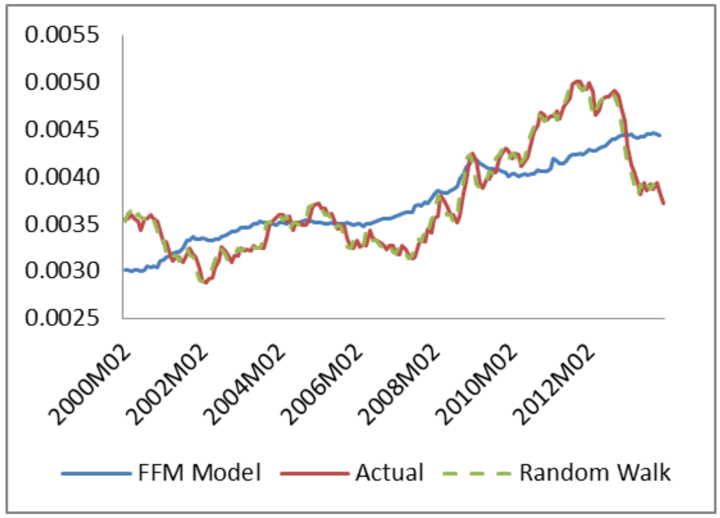
BHD/JPY



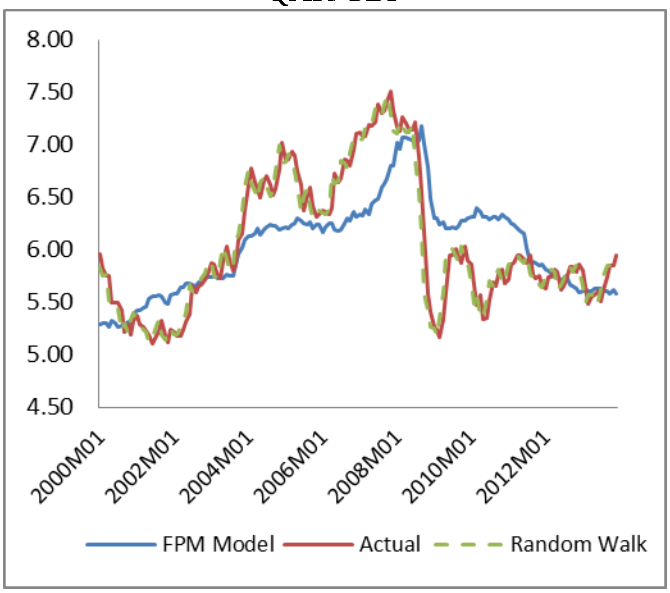
OMR/GBP



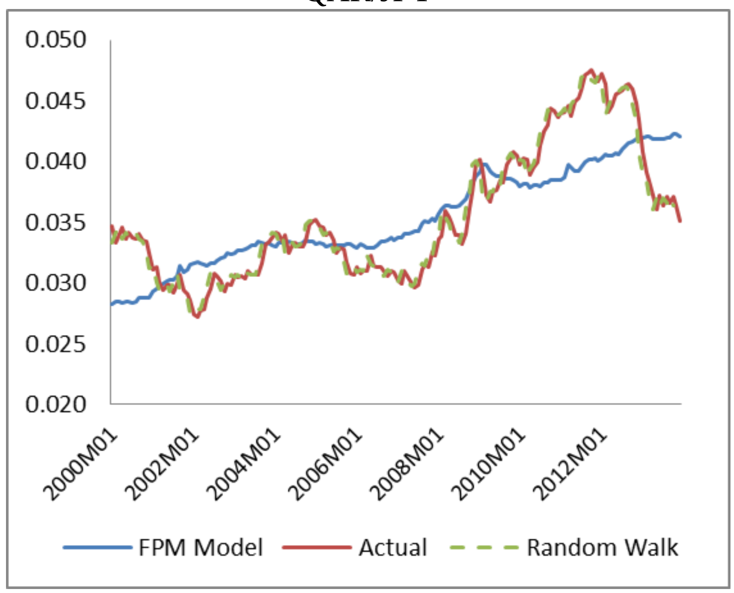
OMR/JPY



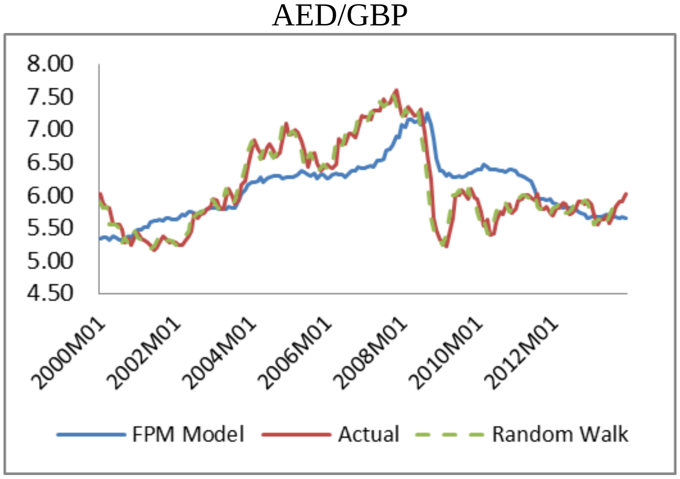
QAR/GBP



QAR/JPY



AED/GBP



AED/JPY

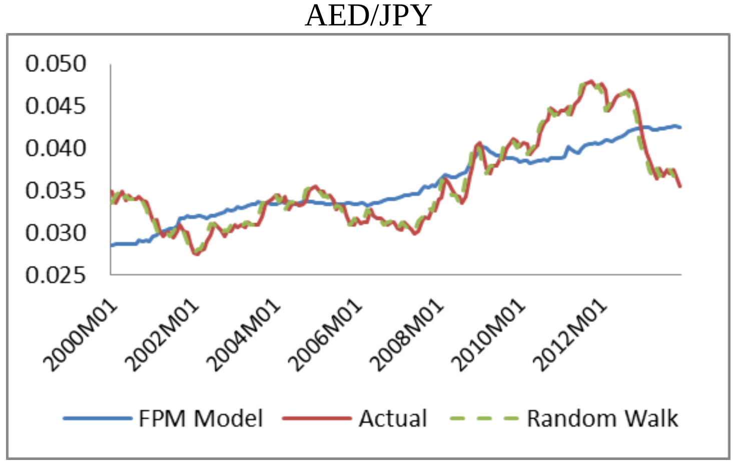
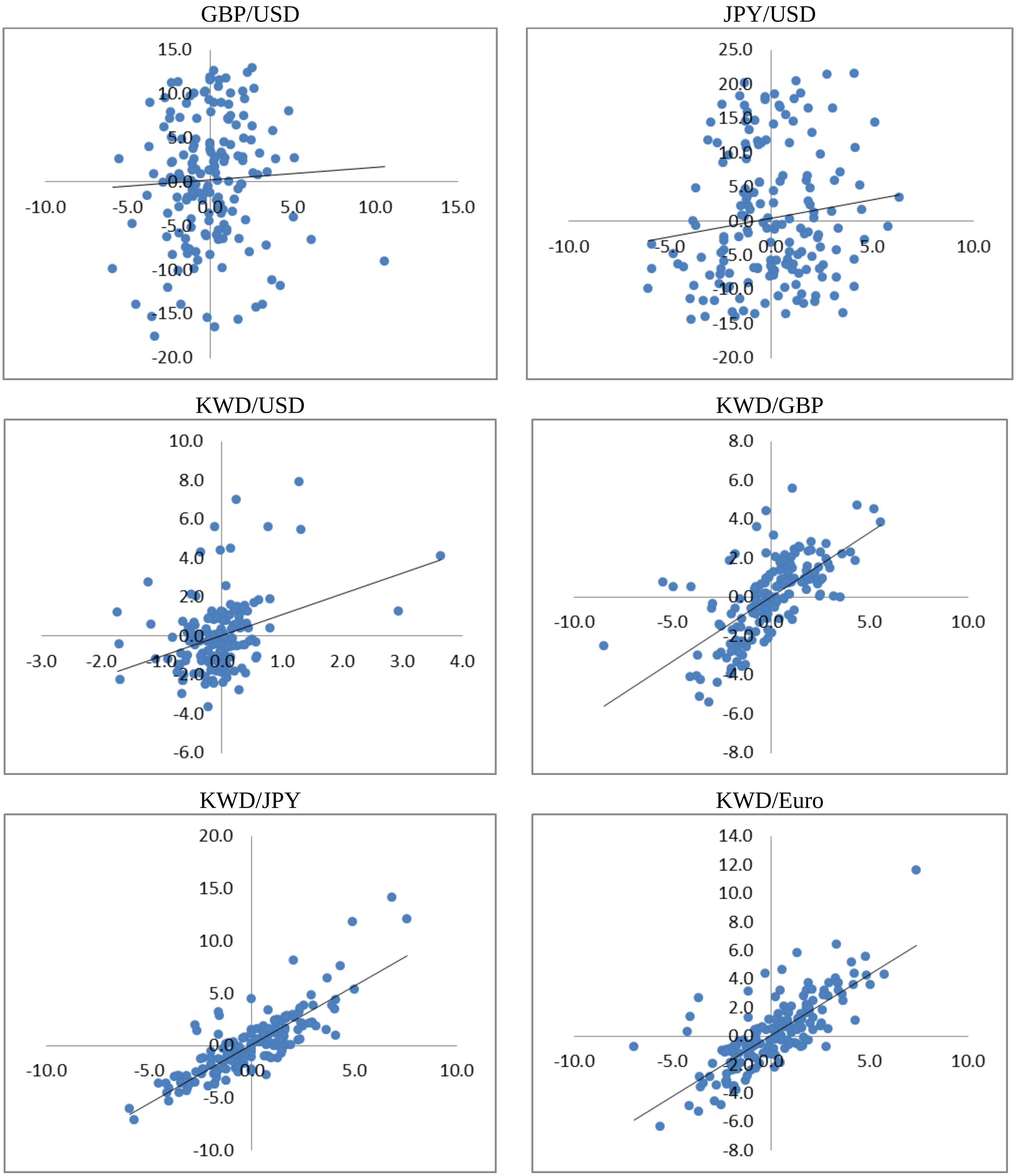
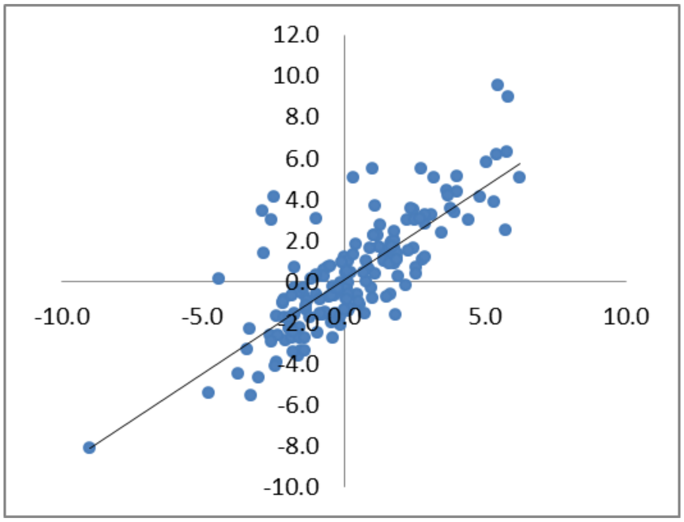


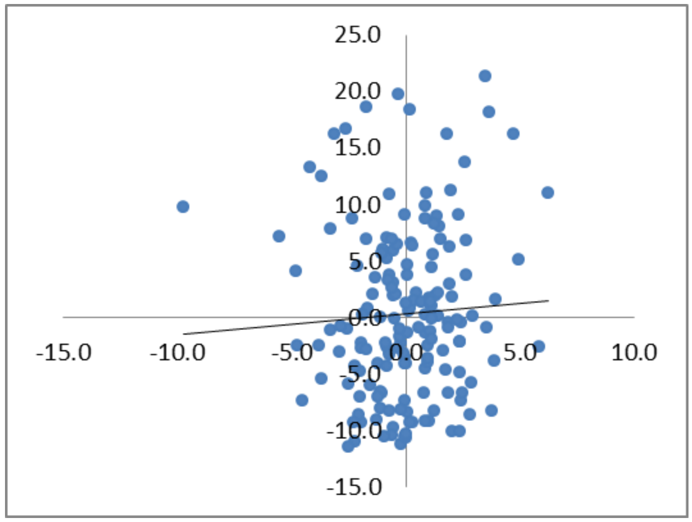
Figure 4.3: Prediction–Realisation Diagrams



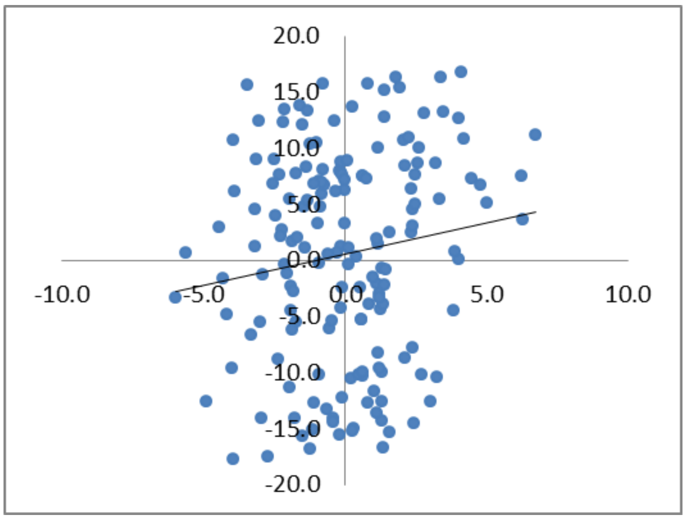
KWD/CHE



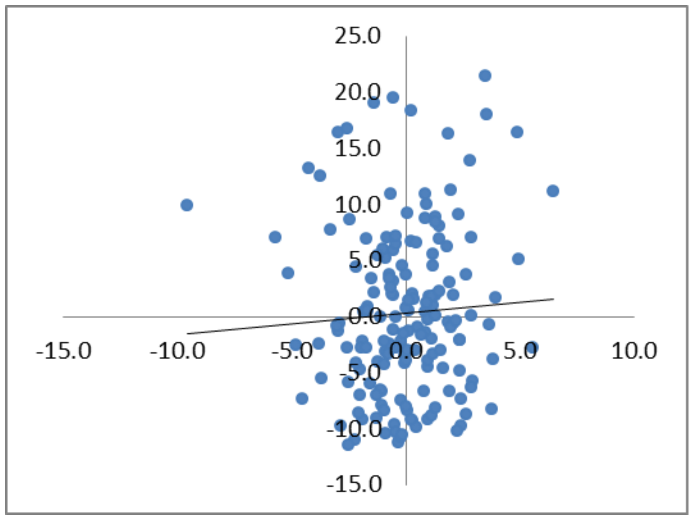
SAR/GBP



SAR/JPY



BHD/GBP



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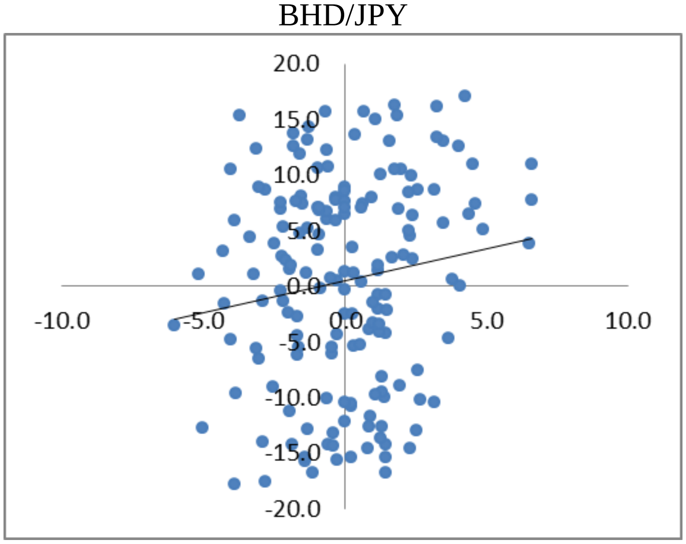

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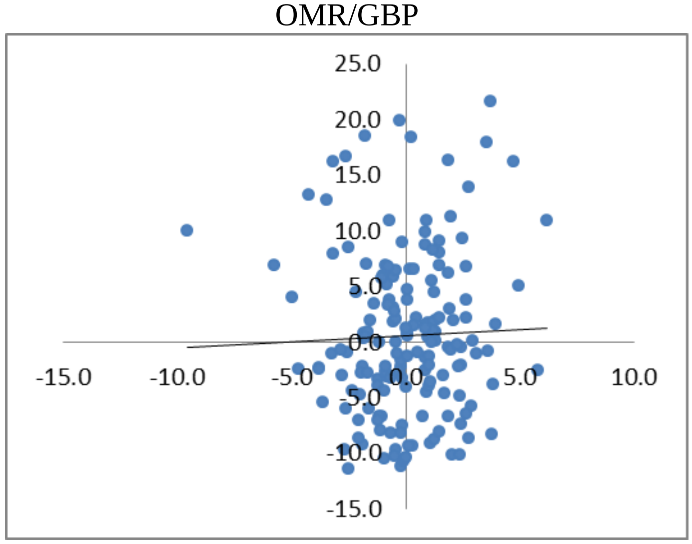
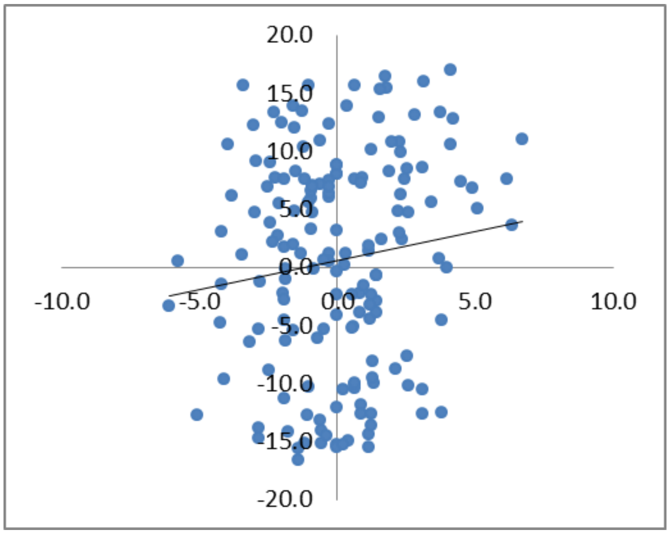
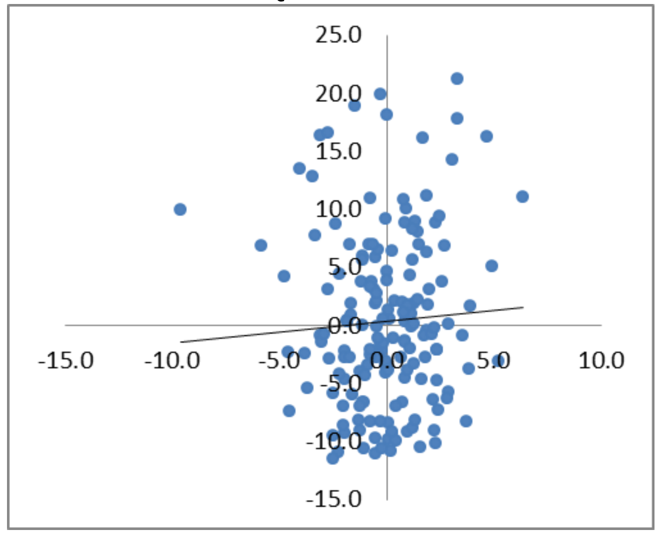


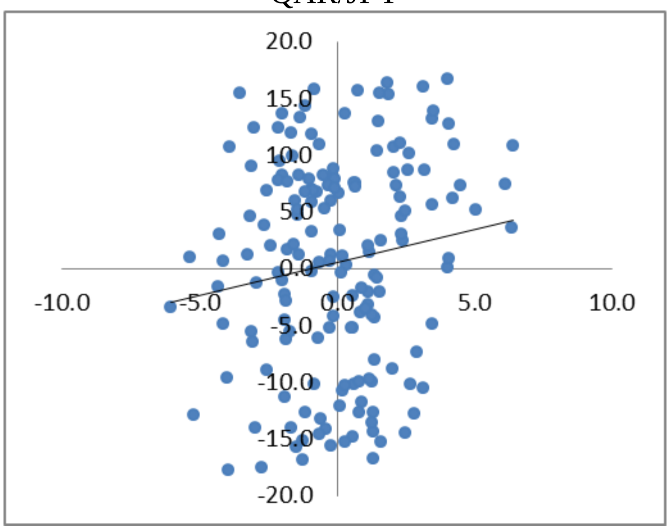
OMR/JPY



QAR/GBP



QAR/JPY



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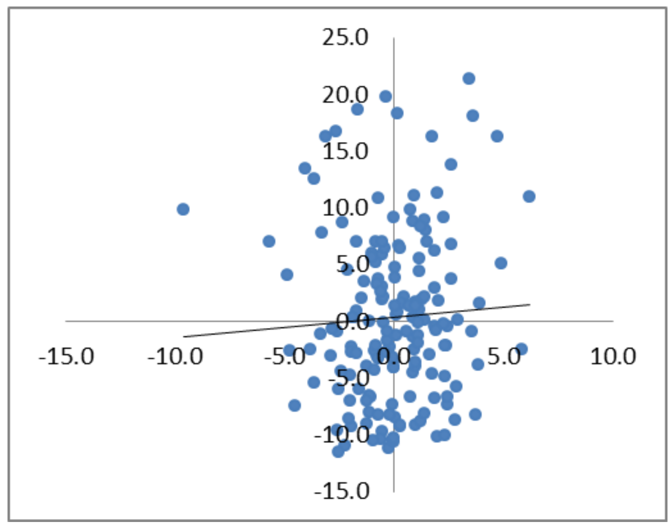

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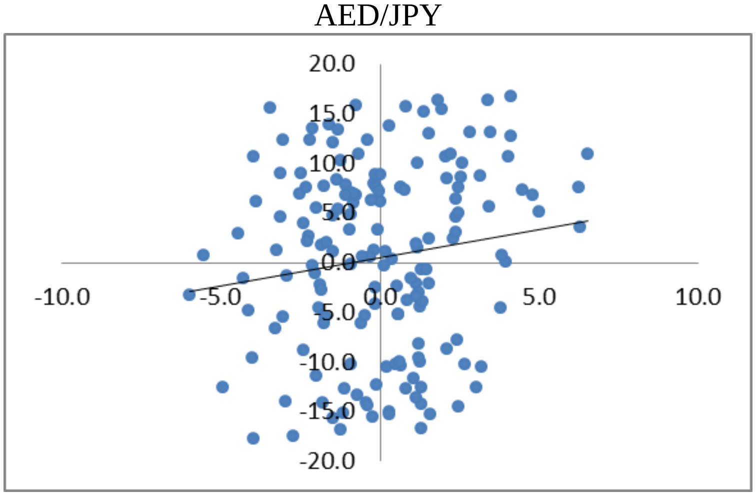


4.6.3 Measures of Forecasting Accuracy

Table 4.6 presents the measures of the forecasting accuracy of the flexible-price monetary model. The results indicate that the random walk model generates numerically lower MAD, MSE and RMSE than the flexible-price monetary model. The forecasting accuracy criteria of the flexible-price monetary model. This is why, in all cases, U is greater than random walk model, suggesting that it is worse than the random walk model in in-sample forecasting, a result that is typically found in the literature. In relation to the ability to predict the direction of change, the flexible-price monetary model does a good job, as DA is higher than 0.5 in most cases, and in all cases it is significantly different from 0. This confirms the behaviour observed in the prediction-realisation figures.

Table 4.6: Forecasting Error of the Flexible-price Monetary Model

Exchange Rate	MAE	MSE	RMSE	U	DA	CR
GBP/USD	0.03520	0.00197	0.04440	1.38547	0.56886	0.43114
JPY/USD	8.21090	0.09650	0.31065	1.40541	0.47305	0.52695
Kuwait						
KWD/USD	0.00337	0.00213	0.04614	2.01045	0.59281	0.40719
KWD/GBP	0.00576	0.00109	0.03298	2.03083	0.78443	0.21557
KWD/JPY	0.00031	0.00092	0.03034	1.99920	0.80240	0.19760
KWD/EURO	0.00435	0.00394	0.06274	2.01489	0.79042	0.20958
KWD/CHE	0.00291	0.00167	0.04088	2.00510	0.79641	0.20359
KSA						
SAR/GBP	0.03731	0.02229	0.14931	2.34297	0.55689	0.44311
SAR/JPY	0.00030	0.00280	0.01132	1.67091	0.46108	0.53892
Bahrain						
BHD/GBP	0.03697	0.02259	0.15029	2.33383	0.57485	0.42515
BHD/JPY	0.00304	0.00107	0.02114	1.66222	0.44311	0.55689
Oman						
OMR/GBP	0.36126	0.20924	0.45743	2.34200	0.54491	0.45509
OMR/JPY	0.00286	0.00417	0.03452	1.66720	0.47305	0.52695
Qatar						
QAR/GBP	0.36519	0.21385	0.46244	2.34192	0.56886	0.43114
QAR/JPY	0.00289	0.00122	0.01103	1.66688	0.47305	0.52695
UAE						
AED/GBP	0.38481	0.32724	0.57366	2.72818	0.542240	0.45776
AED/JPY	0.00398	0.00233	0.01103	1.68922	0.561800	0.43820

Table 4.7 reports the results of the AGS test. The null hypothesis is that the RMSEs of the random walk model and the monetary model are equal. The null hypothesis is rejected if the chi-square statistic for the Wald test is significant. The test statistics are much higher than the critical values of the chi-square distribution, with two degrees of freedom. The null hypothesis is rejected in all cases, which means that the random walk model always produces a significantly lower RMSE than the monetary model.

Table 4.7: AGS Test Results

Exchange Rate	γ_0	γ_1	Wald $\gamma_0 = \gamma_1 = 0$
(GBP/USD)	0.001995 [7.706585] ***	0.956678 [275.0145] ***	75692.38
(JPY/USD)	0.003313 [14.85555]***	0.974962 [422.5268]***	178749.6
(KWD/USD)	6.73E-05 [0.044234] ***	0.528054 [3.095410] ***	9.581566
(KWD/GBP)	0.000175 [0.099931]	-0.039416 [-1.424402]	9.99865
(KWD/JPY)	0.000610 [0.257437]**	0.342130 [13.61196]**	13.13540
(KWD/EURO)	7.07E-05 [0.998071]***	0.999814 [941.3634]***	886165.1
(KWD/CHE)	0.000168 [0.033718]**	0.814467 [3.828801]**	14.65972
(SAR/GBP)	0.003242 [1.132497] ***	0.719379 [21.45754] ***	237.1233
(SAR/JPY)	0.005270 [1.569875]	0.813268 [24.01472]	579.1713
(BHD/GBP)	0.003199 [1.111821] ***	0.719470 [21.34492] ***	456.8416
(BHD/JPY)	0.005222 [1.566886]***	0.816719 [24.24275]***	590.1660
(OMR/GBP)	0.003037 [0.871033] ***	0.651507 [16.11907]***	260.5830
(OMR/JPY)	0.005176 [1.514352]***	0.820804 [23.49272]***	554.2013
(QAR/GBP)	0.003233 [1.126872]***	0.719160 [21.40720]***	459.5378
(QAR/JPY)	0.005264 [1.571754] ***	0.815532 [24.11142] ***	583.8311
(AED/GBP)	0.003243 [1.133687]***	0.719683 [21.48153]***	462.7416
(AED/JPY)	0.005269 [0.813567]	1.570574 [24.02954]	579.8853

Note: ** and *** indicate statistical significance at 5 and 10 per cent respectively.

4.7 Conclusion

Although the results presented in this chapter establish that the random walk model is unbeatable in terms of the magnitude of the forecasting error, this does not mean that it produces superior forecasts. Meese and Rogoff's results have been simplified over time to imply that the random walk model cannot be outperformed by exchange rate models in out-of-sample (and in-sample) forecasting. However, such a statement must be qualified: the random walk model cannot be outperformed in terms of the magnitude of the forecasting error. The proposition that it cannot be outperformed by exchange rate models is rejected when alternative measures of forecasting accuracy are used. The results demonstrate that exchange rate models can outperform the random walk model in terms of DA. Therefore, the Meese–Rogoff puzzle only holds when forecasting accuracy is assessed by the magnitude of the forecasting error alone; otherwise, it is not a puzzle at all.

Macroeconomic models of exchange rates produce significant forecasting errors because they cannot explain the stylised facts about movements in exchange rates, such as bubbles followed by crashes and volatility clustering. However, these models are superior in terms of DA because the random walk model (without drift), by definition, predicts no change. The finding that the monetary model can correctly predict the direction of change more than 50 per cent of the time indicates that macroeconomics variables are valuable in explaining exchange rate movements.

Chapter 5: Macroeconomic Determinants of Stock Prices

5.1 Introduction

The relationship between macroeconomic variables and stock prices in developed economies has been extensively debated and analysed. Most of the research in this area has indicated that macroeconomic variables (e.g., interest rate, consumer price, money supply, government revenue and expenditure) influence stock prices across a variety of markets and time horizons. Until recently, few studies had examined the relationship between economic variables and GCC stock markets (e.g., Almuraikhi 2005; Al-abduljader 2009).

The relationship between stock prices and macroeconomic variables varies from one stock market to another and may change according to the sample period and data frequency. Therefore, more in-depth research is needed to identify the macroeconomic variables that might affect GCC stock markets. Further, GCC countries are of particular significance, as they have some of the fastest growing economies in the world. Moreover, the capital markets of GCC countries underwent tremendous changes after the adoption of liberalisation policies that made them more open to foreign investors. The significant economic potential of reformed markets has attracted many financial institutions and foreign portfolios from different countries to GCC stock markets.

This study examines how and to what extent GCC stock markets respond to changes in macroeconomic variables. This remains an open empirical question that requires further investigation. Understanding the macroeconomic variables that may affect GCC stock markets by analysing recent data can provide useful insights for investors and policy makers.

This chapter presents a theoretical framework of fundamental analysis as applied to the macroeconomic determinants of stock prices. Thereafter, it discusses the related literature on the effects of selective macroeconomic variables on stock prices, including money supply, interest rates, consumer prices, exchange rates, government expenditure, oil revenue and foreign stock prices. This chapter also discusses whether stock price forecasting models can outperform the random walk model by using in-sample forecasting.

5.2 Literature Review

Typically, the following macroeconomic factors are considered to affect stock prices: economic activity, interest rate, money supply, consumer price inflation, exchange rate and foreign stock prices. In the case of GCC countries, two more variables may be added: government expenditure and oil prices. In general, macroeconomic variables affect stock prices because they affect the variables in the dividend discount model.

An early study by Fama and Schwert (1977) showed that macroeconomic variables influence stock prices. Using error correction modelling, Maysami and Sims (2002) analysed short- and long-run relations between macroeconomic variables and stock returns in Hong Kong and Singapore. The macroeconomic variables included money supply, interest rate, consumer price inflation, exchange rate and real economic activity. The results showed that macroeconomic variables affect stock prices with varying degrees of intensity.

The money supply is one of the most effective tools that can influence stock prices. Sellin (2001) suggested that this variable affects stock prices when monetary policy is expected to change. According to Sellin (2001), an increase in the money supply leads people to anticipate higher inflation and interest rates, and both of these factors have a negative effect on stock prices. Conversely, Sellin (2001) also indicated that the increase in the money supply could cause a stock price rise.

Empirical studies of causality between interest rates and stock prices have produced conflicting results, although, in theory, stock prices and interest rates should be negatively related. Mok (1993) tested for causality between stock prices and the HIBOR for the period 1986–1991 and found that the stock price and the HIBOR are independent series. However, Wu's (2001) study of causality between the interest rate and the STII, which used a monthly distributed-lag model, found that the interest rate significantly influences the STII on a monthly investment horizon. Moreover, Al-Abudljader (2011) showed that interest rates have a negative effect on stock prices for different reasons that reflect the channels of causation or the transmission mechanism.

Economic theory also shows the interaction between stock prices and exchange rates. Dornbusch and Fisher (1980) argued that exchange rate movements lead to stock price movements according to ‘flow-oriented’ models. In contrast, Nieh and Lee (2001) examined causality between stock prices and the exchange rate for G7 countries and found that there is no long-run equilibrium relation between the exchange rate and stock prices for those countries. However, they found a significant relation between the exchange rate and stock prices in the short run.

In early research about the relation between the CPI and stock prices, Fisher (1930) found that real stock returns are influenced by consumer prices because stocks represent claims against real assets, which means that they should offer a hedge against inflation. Subsequent empirical studies have focused on stock returns over short horizons. However, Boudoukh and Richardson (1993) considered long-term interactions and found that normal stock returns and inflation are not correlated for short horizons, but that Fisher’s equation still holds for long horizons.

Finally, one of the most effective variables in stock prices—especially in emerging economies—is the oil price. Stein and Hong (1999) and Torous, Hong and Valkanov (2003) put forward several hypotheses indicating that some properties of oil prices make it interesting to focus on the predictive ability of stock returns and oil prices. Maat, Driesprong and Jacobsen (2004) noted the ability of oil prices to forecast stock returns and argued that the price of oil is a perfect example of a macro variable whose exact effect on the stock market is not yet known, while the oil price variable itself can be observed continuously and easily. They found that an increase in oil prices lowers stock prices, and they argued that, while this result may be inconsistent with the notion of market efficiency, it is consistent with Stein and Hong's (1999) gradual information publishing hypothesis. Sadorsky and Basher (2004) examined the relationship in emerging stock markets and provided robust evidence suggesting that oil prices affect stock prices in emerging markets. Roll, Chen and Ross (1986) tested the influence of oil price changes on asset pricing and found no overall effect, suggesting that oil price risk is not separately rewarded in stock prices. Maat, Driesprong and Jacobsen (2004) found evidence suggesting that investors in stock markets underreact to oil price changes in the short run. As a result, oil price changes can be used to forecast future stock returns.

5.3 Models

5.3.1 Forecasting Stock Price Model

A model with several explanatory variables is used to forecast stock prices. The model is specified as follows:

$$S_t = b_0 + b_1 M_t + b_2 Y_t + b_3 i_t + b_4 P_t + b_5 E_t + b_6 C_t + b_7 S_t^* + v_t \tag{5.1}$$

where *S* is stock prices, *M* is the money supply, *Y* is industrial production, *i* is the interest rate, *P* is consumer prices, *E* is the exchange rate, *C* is commodity prices and S^* is foreign stock prices. For GCC countries, *Y* is replaced with *G*, government expenditure, and *C* is replaced with *O*, oil prices.

The choice of this model specification can be justified in terms of theoretical considerations, as the explanatory variables are intuitively related to the dependent variable. It can also be justified in terms of the available evidence produced by studies of the macroeconomic determinants of stock prices. Some versions of this model have been used by Al-Abduljader (2009), Al-Muraikhi (2005) and by Al-Abduljader and Al-Muraikhi (2011).

5.3.2 Random Walk Model

The random walk model is a simple model that assumes that there is a 50 per cent chance of the stock price going up and a 50 per cent chance of it going down. Implicitly, it states that the stock price yesterday will be the same as the stock price today. The random walk model with drift is written as:

$$S_t = \alpha + S_{t-1} + \varepsilon_t \tag{5.2}$$

5.3.3 Unit Root Testing

The necessity of testing for stationarity stems from the possibility of spurious regression. Other reasons for conducting unit root tests include the following: (i) it is interesting to determine whether shocks have transitory or permanent effects; (ii) the unit root test is significant for forecasting to determine whether the process has an attractor; and (iii) stationarity is essential for the central limit theorem and the law of large numbers.

Testing for the unit root is based on the autoregressive equation:

$$y_t = \beta y_{t-1} + \varepsilon_t \tag{5.3}$$

which gives:

$$\Delta y_t = (\beta - 1) y_{t-1} + \varepsilon_t \tag{5.4}$$

If $H_0: \beta = 1$ cannot be rejected, y_t is a non-stationary time series. The Dickey–Fuller (DF) test is designed to investigate the presence of the unit root and the order of integration in a time series sample. Thus, Equation (5.4) can be written as:

$$\Delta y_t = \gamma y_{t-1} + \varepsilon_t \tag{5.5}$$

The guideline of identifying the unit root test is based on rejecting the null hypothesis $H_0: \gamma = 0$, which means that a significantly negative test statistic is required to reject it. Equation (5.5) does not have a time trend or a constant term. However, the test statistics are non-standard under the null of non-stationarity. Fuller (1985) suggested that the limiting distribution of the asymptotic variance of the parameter is not defined for non-stationarity time series.

Another version of the underlying regression equation is:

$$\Delta y_t = \alpha + \gamma y_{t-1} + \varepsilon_t \tag{5.6}$$

In this case, the above equation includes a constant term in which the *t*-statistic is defined as τ_u. Further, the *t*-statistic is known as τ_τ if the regression equation has a time trend and a constant term α:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \varepsilon_t \tag{5.7}$$

The above equation can be used to test two hypotheses—the random walk model with and without drift—as follows:

- For the random walk model with drift, the null hypothesis is $H_0: \beta = \gamma = 0$.
- For the random walk model without drift, the null hypothesis is $H_0: \alpha = \beta = \gamma = 0$.

If the F-statistic has a value greater than the critical values, H_0 is rejected (Dickey and Fuller 1981).

Due to the possible presence of time-varying heteroscedasticity or serial correlation, the error term ε_t in the DF regression equation might not be white noise. The problem can be avoided by resorting to parametric and non-parametric solutions. The ADF regression is:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \sum_{i=1}^{p} \delta_i \, \Delta y_{t-i} + \varepsilon_t \tag{5.8}$$

where *p* is the lag length.

The test statistic is calculated in a similar fashion to the original DF regression equation, as represented by Equations (5.6) and (5.7). For example, if *p*=3, the ADF regression becomes:

$$\Delta y_t = \alpha + \beta t + \gamma y_{t-1} + \delta_1 \, \Delta y_{t-1} + \delta_2 \, \Delta y_{t-2} + \delta_3 \, \Delta y_{t-3} + \varepsilon_t \tag{5.9}$$

The lag length (*p*) must rise with the sample size. However, a problem might arise when the value of the lag length (*p*) increases, which is the loss of the degree of freedom. The value of *p* might need to be increased to eliminate autocorrelation.

5.3.4 Cointegration Analysis

Cointegration analysis is used to study the existence of an equilibrium relationship between two or more time series variables. Thus, cointegration analysis is used in conjunction with time series data. Two conditions must be satisfied to establish cointegration: (i) the data series should be integrated of the same order (1); and (ii) a linear combination of the time series is integrated of the order 0. If these conditions are satisfied, the underlying time series are stationary.

To explain the concept of cointegration, we assume that two non-stationary time series variables, y_t and x_t, are related by the linear relationship:

$$y_t = \alpha + \beta x_t + u_t \tag{5.10}$$

If y_t and x_t are not cointegrated, they will tend to move apart over time, which means that u_t will deviate from its mean value. If $y_t \sim I(1)$ and $x_t \sim I(1)$, cointegration exists if $u_t \sim I(0)$.

Engle and Granger (1978) developed many techniques to test the residuals for unit root. The most appropriate tests are the ADF and DF statistics, although the Durbin–Watson (DW) statistic can be used for the same purpose.

The DF statistic is the t ratio of ɳ in the DF regression as applied to the residuals:

$$\Delta u_t = \eta u_{t-1} + v_t \tag{5.11}$$

H_0 is rejected (i.e., cointegration is present) when the value of the *t*-statistic is significantly negative.

Engle and Granger prefer the ADF statistic to the DF. Like the DF statistic, the ADF statistic is simply the t ratio of the coefficient ɳ in the DF regression, which can be written for the residual as:

$$\Delta u_t = \eta u_{t-1} + \sum_{i=1}^{p} \emptyset_i \Delta u_{t-i} + v_t \tag{5.12}$$

The DW statistic is also used to test for cointegration, except that the critical values are not the same as those used to test for autocorrelation. In this case, the critical values are interpolated using the response surface as in Engle and Granger (1987).

5.3.5 Error Correction-based Cointegration Testing

Testing for cointegration can be conducted on the basis of the t-statistic of the coefficient on the ECT. Kremers et al. (1992) suggested that cointegration can be realised when the coefficient is negative and statistically significant. They showed that while the DF test cannot reject the H_0 of no cointegration, the coefficient on the ECT can be negative and statistically significant. In addition, they justified inconsistency in the findings of the two tests by arguing that the contrast is due to the implied common factor restriction when the DF test is used. Further, they argued that the t-statistic of the coefficient on the ECT is normally distributed, as opposed to the DF statistic, which has a non-normal distribution.

5.3.6 Granger's Representation Theorem

Granger's representation theorem states that cointegration implies and is implied by the existence of a valid EC representation. For example, when the variables y and x are cointegrated with a cointegration parameter β, such that $z_t = y_t - \beta x_t$, EC representation can be specified by the following formulas:

$$\Delta y_t = \alpha_1 \Delta y_{t-1} + \alpha_2 \Delta y_{t-2} + \cdots + \alpha_k \Delta y_{t-k} + \beta_1 \Delta x_{t-1} + \beta_2 \Delta x_{t-2} + \cdots + \beta_k \Delta y_{t-k} + \gamma z_{t-1} + u_t \quad (5.13)$$

and:

$$\Delta x_t = \theta_1 \Delta y_{t-1} + \theta_2 \Delta x_{t-2} + \cdots + \theta_k \Delta x_{t-k} + \emptyset_1 \Delta y_{t-1} + \emptyset_2 \Delta y_{t-2} + \cdots + \emptyset_k \Delta y_{t-k} + \delta z_{t-1} + v_t \quad (5.14)$$

where either δ and γ is a non-zero coefficient. The variables y and x are cointegrated if the coefficient on the ECT is significantly negative.

5.3.7 Cointegration and Causality Tests

The difference between cointegration and causality is that cointegration is about a long-run equilibrium relationship between two or more variables, whereas causality is about short-term temporal ordering. If y and x are cointegrated, the EC representation can be written as:

$$\Delta y_t = \theta_1 z_{t-1} + \sum_{i=1}^{p} \beta_{1i} \Delta x_{t-i} + \sum_{i=1}^{p} \gamma_{1t} \Delta y_{t-i} + \varepsilon_{1t} \quad (5.15)$$

and:

$$\Delta x_t = \theta_2 z_{t-1} + \sum_{i=1}^{p} \beta_{2i} \Delta x_{t-i} + \sum_{i=1}^{p} \gamma_{2t} \Delta y_{t-i} + \varepsilon_{2t} \quad (5.16)$$

where $z_t = y_t - \beta x_t$. Equations (5.15) and (5.16) specify that either y_t and x_t is caused by z_{t-1}. Therefore, if the two variables y_t and x_t are cointegrated, one variable y_t is caused by the other variable x_t, and vice versa. Reimers and Lutkiptil (1989) had a different opinion on the validity of testing causality in a cointegrated system.

Cointegration is a prerequisite for testing causality. Selecting the suitable representation is conditional on whether cointegration is present. If cointegration is present, the ECM can be utilised, in which case testing for causality is conducted on the basis of the model:

$$\Delta y_t = \theta + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \sum_{i=1}^{p} \emptyset_1 \Delta y_{t-i} + \delta z_{t-1} + \varepsilon_t \quad (5.17)$$

where δ is the coefficient on the ECT. Conversely, if the null hypothesis H_0 of no cointegration cannot be rejected, then a straight first difference model can be used. The model is written as:

$$\Delta y_t = \theta + \sum_{i=1}^{p} \gamma_i \Delta x_{t-i} + \sum_{i=1}^{p} \emptyset_i \Delta y_{t-i} + v_t \qquad (5.18)$$

In this case, the long- and short-term causality from one variable to another (as from *x* to *y*) can be tested using the null hypotheses:

$$H_0: \gamma_i = 0 \forall i$$

and:

$$H_0: \delta = 0$$

Testing for causality from y to x can be conducted in the same way, except that the positions of *x* and *y* in Equations (5.17) and (5.18) must be reversed.

5.4 Forecast Evaluation Criteria

By now, it is apparent that exponential smoothing techniques tend to lag behind the turning points of the actual time series data. The usefulness of the forecast is best determined by evaluating its associated errors. Of course, smaller error values are better than larger errors when comparing the different values of the smoothing parameters. The same holds when comparing different forecasting models. Forecast evaluation criteria provide several useful measures of forecast errors. Choosing which error term to focus on is part of the ‘art’ of forecasting. Generally, in business and economics, the focus shifts to the MAE, MSE, RMSE and other forecast criteria.

5.4.1 Mean Square Error

The MSE is a common measure of forecasting accuracy. It is the average of the squares of the errors measured by the difference between the actual and forecast values. The MSE can be defined as:

$$MSE = \frac{1}{n}\sum_{t=1}^{n}\left(S_t - \hat{S}_t\right)^2 \tag{5.19}$$

The better of two forecasts must have a lower MSE.

5.4.2 Root Mean Square Error

The RMSE is a frequently used measure of forecasting accuracy. It is the square root of the MSE:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}\left(S_t - \hat{S}_t\right)^2} \tag{5.20}$$

The RMSE of the random walk model is calculated as:

$$RMSE = \sqrt{\frac{1}{n}\sum_{t=1}^{n}(S_{t-1} - S_t)^2} \tag{4.21}$$

By calculating the MSE and RMSE, greater forecasting errors are penalised more heavily, which follows from the squaring of the errors.

5.4.3 Mean Absolute Error

The MAE is similar in concept to the MSE, although it is less sensitive to outliers than the MSE. The MAE's use of absolute deviations is more effective if the economic effect of forecasting errors is proportional to the magnitude of the errors. The MAE is calculated as:

$$MAE = \frac{1}{n}\sum_{t=1}^{n}\left|S_t - \hat{S}_t\right| \tag{5.22}$$

The reason for using the absolute values of the errors is that large negative and positive errors cancel each other out, which may make a bad model look good.

5.4.4 Theil's Inequality Coefficient (*U*)

U is a measure of the predictive power of a model relative to the random walk. It is calculated as:

$$Thiel's\ U = \frac{\sqrt{\frac{1}{n-1}\sum_{t=1}^{n}(S_{t+1} - \hat{S}_{t+1})^2}}{\sqrt{\frac{1}{n-1}\sum_{t=1}^{n}(S_{t+1} - S_t)^2}} \tag{5.23}$$

If $U = 0$, the model produces a perfect forecast. If $0 < U < 1$, the model produces less-than-perfect forecasts. It outperforms the random walk model when U=1, which implies that the model performs better than the random walk model. Finally, if $U > 1$, the model is worse than the random walk model. By definition, Theil's U for the random walk model is 1.

5.4.5 Direction Accuracy and the Confusion Rate

DR and CR are measures of the ability of a stock price forecasting model power to predict the direction of change. In some financial decision-making situations, forecasting the direction of change is more important than the magnitude of the forecasting error (e.g., Moosa 2006). DR and CR are calculated as:

$$DA = \frac{1}{n-1}\sum_{t=1}^{n} a_{t+1} \tag{5.24}$$

and:

$$CR = 1 - \frac{1}{n-1}\sum_{t=1}^{n} a_{t+1} \tag{5.25}$$

where $a_{t+1} = 1$ if $(S_{t+1} - S_t)$ $(\hat{S}_{t+1} - S_t)$ is greater than zero and $a_{t+1} = 0$ otherwise. This implies that a takes a value of 1 if the predicted and actual changes have the same sign, and if a = 0, the predicted and actual changes have opposite signs. If $\left(S_{t+1} - S_t \right)\left(\hat{S}_{t+1} - S_t \right)$ is greater than 0 for all t, the value of DA will be 1, implying that the model predicts the change correctly on all occasions. In this case, CR = 0.

5.4.6 Correlation between Actual Change and Predicted Change

The correlation between actual change and predicted change is a measure of the strength and direction of the linear relationship between the actual and predict time series. It is calculated as:

$$R = \frac{Cov(S_t, \hat{S}_t)}{\sqrt{Var(S_t)Var(\hat{S}_t)}} \tag{5.26}$$

A model with forecasting accuracy should produce forecasts that are highly correlated with the actual values of the underlying variables.

5.4.7 AGS Test

The AGS test is used to formally test the predictive accuracy of the stock price forecasting model against that of the random walk model. The AGS test requires the estimation of the linear regression:

$$D_t = \gamma_0 + \gamma_1(M_t - \bar{M}) + \mu_t \tag{5.27}$$

where $D_t = w_{1t} - w_{2t}$ and $M_t = w_{1t} + w_{2t}$. $\bar{M}$ is the mean of M, w_{1t} is the forecasting errors at time t of the model with the higher RMSE and w_{2t} is the forecasting errors at time t of the model with the lower RMSE. If the sample mean of the forecasting error is negative, the observations of the time series must be multiplied by -1 before running the regression. The estimates of the intercept γ_0 and slope term γ_1 are used to test the statistical difference between the RMSEs of two models. If the estimates of γ_0 and γ_1 are both positive, the Wald test of joint null hypothesis $H_0 : \gamma_0 = \gamma_1 = 0$ is appropriate. If one of the estimated coefficients is negative but statistically significant, the test is inconclusive. If the estimate is negative and statistically insignificant, the test remains conclusive, in which case the significance is determined by the upper tail of the t-test of the positive coefficient estimate.

5.5 Data

Monthly time series data for all macroeconomic variables are employed. The macroeconomic variables used in this study are the CPI, money supply (local currency), government expenditure (local currency), exchange rate, oil revenue (local currency), interest rate, industrial production and foreign stock price. In addition, this study includes the closing spot exchange rate of the GCC currencies in terms of the USD and GBP (the currencies are pegged to the US dollar, except the Kuwait currency, which is pegged to a basket of currencies). The data series were retrieved from Datastream, except for the Bahrain and Oman stock prices, which were obtained from the official stock exchange websites of these countries. Table 5.1 lists the countries, currencies and stock market indices.

Table 5.1: List of Countries, Currencies and Stock Market Indices

Country	Index	Currency
Kuwait	KSE	KWD
Saudi Arabia	SSE	SAR
Bahrain	BBE	BHD
Oman	MSE	OMR
Qatar	QSE	QAR
UAE	ADX	AED

5.6 Basic Statistics and Unit Root Test Results

Table 5.2 summarises the basic statistics for all macroeconomic variables under investigation: domestic stock price (S), money supply (M), interest rate (I), exchange rate (E), consumer price index (P), government expenditure (G), oil revenue (O) and foreign stock price (S^*). The values of the kurtosis and skewness suggest that there is a lack of symmetry in the distribution. In general, if the values of kurtosis and skewness are 3 and 0 respectively, the observed distribution can be said to be normal. Moreover, if the coefficient of skewness exceeds unity, it is considered fairly extreme—a high (low) kurtosis value suggests extreme leptokurtic (platykurtic). As shown in Table 5.2, the distributions of all variables are unlikely to be normal. The significance of the Jarque–Bera statistics of all variables also indicates that the distributions of the data series are not normal. Further, the value of standard deviations suggests that the interest rate, government expenditure and oil revenue are relatively more volatile compared to CPI, exchange rate, money supply and foreign stock price.

Table 5.2: Descriptive Statistics—Macroeconomics Variables

	Ln(S)	Ln(M)	Ln(I)	(E)	Ln(C)	Ln(G)	Ln(O)	Ln(S^*)
Kuwait								
Mean	8.877	9.688	0.796	0.289	6.906	6.282	7.156	9.302
Median	8.910	9.671	0.902	0.286	6.859	6.182	7.335	9.285
Maximum	9.646	10.400	1.954	0.312	7.181	9.072	8.148	9.716
Minimum	7.206	8.957	-0.470	0.274	6.715	4.305	5.870	8.863
Std. Dev.	0.504	0.470	0.760	0.011	0.162	0.745	0.653	0.164
Skewness	-1.529	-0.052	-0.110	0.836	0.308	0.362	-0.330	0.044
Kurtosis	5.973	1.493	1.684	2.465	1.487	4.109	1.746	2.897
Jarque-Bera	127.341	15.983	12.471	21.582	18.680	12.281	14.061	0.127
Probability	0.000	0.000	0.002	0.000	0.000	0.002	0.001	0.939
Obs.	168	168	168	0.289	168	168	168	168
KSA								
Mean	8.52202	6.30200	0.68751	1.32135	4.58249	12.6205	6.18478	9.30161
Median	8.73255	6.28686	0.73429	1.32168	4.50203	12.5245	6.32549	9.28495
Maximum	9.80332	7.20451	1.95331	1.32245	4.85515	13.8323	7.13298	9.71575
Minimum	7.13042	5.48149	-1.59998	1.31504	4.44029	11.2413	4.95617	8.86262
Std. Dev.	0.66186	0.54926	0.60427	0.00084	0.14704	0.44501	0.51656	0.16369
Skewness	-0.70070	0.01879	-0.20559	-4.05104	0.57436	-0.05149	-0.27798	0.04357
Kurtosis	2.66181	1.58677	2.05747	25.8277	1.69724	1.32262	1.77088	2.89749
Jarque-Bera	14.5482	13.9904	7.40211	4107.22	21.1172	19.7695	12.7387	0.12670
Probability	0.00069	0.00092	0.02469	0.00000	0.00003	0.00005	0.00171	0.93862
Obs.	168	168	168	168	168	168	168	168
Bahrain								
Mean	7.359759	8.383992	0.846268	4.574870	7.452398	3.633758	9.301612	0.375421
Median	7.338137	8.321489	0.751416	4.503886	7.431549	3.613594	9.284948	0.375500
Maximum	7.993202	9.125327	1.962908	4.787492	8.222331	3.834139	9.715751	0.377000
Minimum	6.310722	7.574045	0.058269	4.355839	6.885407	3.574180	8.862615	0.372400
Std. Dev.	0.372573	0.525623	0.632318	0.139113	0.448671	0.066362	0.163695	0.001290
Skewness	-0.33501	-0.01339	0.354700	0.099149	0.213779	2.084073	0.043567	-0.44312
Kurtosis	2.629736	1.386437	1.600768	1.267991	1.582634	6.433933	2.897493	2.105837
Jarque-Bera	4.102214	18.23011	17.22769	21.27424	15.34213	204.1573	0.126700	11.09458
Probability	0.128592	0.000110	0.000182	0.000024	0.000466	0.000000	0.938615	0.003898
Obs.	168	168	168	168	168	168	168	168
Oman								
Mean	6.040029	9.688043	0.795926	9.208798	0.383993	8.584285	7.156255	9.301612
Median	6.295580	9.670880	0.902118	9.161150	0.383900	8.484460	7.335049	9.284948
Maximum	7.064095	10.40022	1.953737	9.483416	0.385000	11.37505	8.147745	9.715751
Minimum	4.985933	8.956828	-0.47000	9.017968	0.382600	6.608001	5.870109	8.862615
Std. Dev.	0.546356	0.470071	0.759599	0.162194	0.000547	0.744878	0.653156	0.163695
Skewness	-0.44786	-0.05235	-0.11043	0.30845	0.28941	0.36241	-0.33035	0.04357
Kurtosis	1.968011	1.492595	1.683667	1.487390	2.681861	4.108604	1.746116	2.897493
Jarque-Bera	13.07127	15.98261	12.47062	18.67988	3.053778	12.28057	14.06121	0.126700
Probability	0.001451	0.000338	0.001959	0.000088	0.217210	0.002154	0.000884	0.938615
Obs.	168	168	168	168	168	168	168	168

Table 5.2: Continued

	Ln(S)	Ln(M)	Ln(I)	(E)	Ln(C)	Ln(G)	Ln(O)	Ln(S^*)
Qatar								
Mean	8.547663	5.128653	0.799969	0.383993	3.704245	10.36755	17.88194	9.301612
Median	8.873470	5.032054	0.751416	0.383900	3.687784	10.45712	17.93721	9.284948
Maximum	9.427344	6.134755	1.927164	0.385000	3.835368	11.53725	19.04706	9.715751
Minimum	7.067422	4.477265	-0.35668	0.382600	3.637807	9.361279	16.33984	8.862615
Std. Dev.	0.731597	0.482006	0.655229	0.000547	0.059408	0.771065	0.832655	0.163695
Skewness	-0.93940	0.549300	0.122601	0.289414	0.635606	0.009347	-0.20878	0.043567
Kurtosis	2.405570	2.123532	1.759133	2.681861	2.139070	1.496195	1.633678	2.897493
Jarque-Bera	27.18284	13.82584	11.19912	3.053778	16.50027	15.83246	14.28836	0.126700
Probability	0.000001	0.000995	0.003699	0.217210	0.000261	0.000365	0.000789	0.938615
Obs.	168	168	168	168	168	168	168	168
UAE								
Mean	7.779222	5.877988	0.622229	5.011432	1.300799	10.91986	18.73005	9.301612
Median	7.870907	5.996778	0.693147	4.778493	1.300805	10.89369	18.87063	9.284948
Maximum	8.732687	6.962972	1.749200	6.150962	1.300982	11.56593	19.69942	9.715751
Minimum	6.856784	4.461614	-0.139262	4.540886	1.299892	9.595627	17.46337	8.862615
Std. Dev.	0.501511	0.818472	0.614588	0.359102	0.000150	0.481383	0.633625	0.163695
Skewness	-0.283561	-0.407732	0.367303	1.155171	-2.663907	-0.434839	-0.273779	0.043567
Kurtosis	2.107956	1.705531	1.702839	3.593898	15.21353	2.427096	1.747003	2.897493
Jarque-Bera	7.821595	16.38443	15.55591	39.83277	1242.891	7.591925	13.08876	0.126700
Probability	0.020025	0.000277	0.000419	0.000000	0.000000	0.022461	0.001438	0.938615
Obs.	168	168	168	168	168	168	168	168

To examine the stationarity of the time data series, we use the standard procedure of testing for unit root—that is, the ADF test—such that the lag length is selected based on the AIC. Given the alleged low power of the ADF test, two more tests are used: the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test and the Phillips–Perron (PP) test. Table 5.3 presents the results, which show that the data series are non-stationary in levels. In first differences, some variables are stationary at the 1 per cent level and others are stationary at the 5 per cent level. Thus, all variables are integrated of order 1. Figures 5.1–5.86 show the GCC macroeconomic variables in levels and first differences.

Table 5.3: Unit Root Test Results

Macroeconomics Variables	ADF Test	PP Test	KPSS Test	Order of Integration
	H_0: Variable is non-stationary	H_0: Variable is non-stationary	H_0: Variable is stationary	
Kuwait				
$\mathrm{Ln}(S)$	-1.434396	-1.351917	0.132122	
$\Delta\mathrm{Ln}(S)$	-8.786277***	-8.809060***	0.381037*	I(1)
$\mathrm{Ln}(\mathrm{M})$	-0.375539	-0.375187	1.624473	
$\Delta\mathrm{Ln}(\mathrm{M})$	-13.57031***	-13.55383***	0.119519***	I(1)
$\mathrm{Ln}(\mathrm{I})$	-1.234779	-1.398947	1.096010	
$\Delta\mathrm{Ln}(\mathrm{I})$	-11.16534***	-11.14476***	0.050713***	I(1)
$\mathrm{Ln}(\mathrm{E})$	-1.443730	-1.176654	1.307813	
$\Delta\mathrm{Ln}(\mathrm{E})$	-9.816895***	-9.765681***	0.074194***	I(1)
$\mathrm{Ln}(\mathrm{C})$	1.596985	1.265053	1.585347	
$\Delta\mathrm{Ln}(\mathrm{C})$	-13.00055***	-13.32915***	0.517480**	I(1)
$\mathrm{Ln}(\mathrm{G})$	-2.308102	-1.203302	0.129519	
$\Delta\mathrm{Ln}(\mathrm{G})$	-5.515718***	-9.526686***	0.314107*	I(1)
$\mathrm{Ln}(\mathrm{O})$	-1.180251	-1.283883	1.430914	
$\Delta\mathrm{Ln}(\mathrm{O})$	-10.00116***	-10.11491***	0.044369***	I(1)
$\mathrm{Ln}(S^*)$	-0.783808	-1.095552	0.647624*	
$\Delta\mathrm{Ln}(S^*)$	-12.09506***	-12.13271***	0.165228***	I(1)
KSA				
$\mathrm{Ln}(S)$	-1.972518	-1.955777	0.849956	
$\Delta\mathrm{Ln}(S)$	-9.549047***	-9.640520***	0.260697***	I(1)
$\mathrm{Ln}(\mathrm{M})$	0.561213	0.607843	1.630275	
$\Delta\mathrm{Ln}(\mathrm{M})$	-13.42788***	-13.43562***	0.206224***	I(1)
$\mathrm{Ln}(\mathrm{I})$	-1.895141	-1.713519	0.857061	
$\Delta\mathrm{Ln}(\mathrm{I})$	-5.293556***	-12.90520***	0.062988***	I(1)
$\mathrm{Ln}(\mathrm{E})$	-1.622082	-1.801420	1.440112	
$\Delta\mathrm{Ln}(\mathrm{E})$	-3.845258***	-3.964212***	0.504636**	I(1)
$\mathrm{Ln}(\mathrm{C})$	1.047849	2.060794	1.496002	
$\Delta\mathrm{Ln}(\mathrm{C})$	-3.806191***	-10.28692***	0.922777*	I(1)
$\mathrm{Ln}(\mathrm{G})$	-1.204688	-1.204688	0.870352	
$\Delta\mathrm{Ln}(\mathrm{G})$	-12.88346***	-12.88345***	0.188516***	I(1)
$\mathrm{Ln}(\mathrm{O})$	-1.252964	-1.329593	1.432243	
$\Delta\mathrm{Ln}(\mathrm{O})$	-9.766755***	-9.801587***	0.035925***	I(1)
$\mathrm{Ln}(S^*)$	-0.783808	-1.095552	0.647624*	
$\Delta\mathrm{Ln}(S^*)$	-12.09506***	-12.13271***	0.165228***	I(1)

Notes: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively. Δ represents first difference.

Table 5.3: Continued

Macroeconomics Variables	ADF Test H_0: Variable is non-stationary	PP Test H_0: Variable is non-stationary	KPSS Test H_0: Variable is stationary	Order of Integration
Bahrain				
$\mathrm{Ln}(S)$	-1.559321	-1.635796	0.209896	
$\Delta\mathrm{Ln}(S)$	-8.662193***	-9.873322***	0.097132***	I(1)
$\mathrm{Ln}(\mathrm{M})$	-0.591268	-0.590244	1.610682	
$\Delta\mathrm{Ln}(\mathrm{M})$	-3.239202***	-14.32606***	0.216821***	I(1)
$\mathrm{Ln}(\mathrm{I})$	-1.640085	-1.505673	0.573824**	
$\Delta\mathrm{Ln}(\mathrm{I})$	-6.169176***	-12.49876***	0.133998***	I(1)
$\mathrm{Ln}(\mathrm{E})$	-2.374937	-1.631519	1.125116	
$\Delta\mathrm{Ln}(\mathrm{E})$	-16.52882***	-18.14104***	0.037319***	I(1)
$\mathrm{Ln}(\mathrm{C})$	-0.838503	-0.801652	1.537325	
$\Delta\mathrm{Ln}(\mathrm{C})$	-15.58182***	-17.16016***	0.096854***	I(1)
$\mathrm{Ln}(\mathrm{G})$	0.458478	1.561892	1.600115	
$\Delta\mathrm{Ln}(\mathrm{G})$	-2.793941***	-2.734443*	0.569688*	I(1)
$\mathrm{Ln}(\mathrm{O})$	0.193368	0.227733	0.468021*	
$\Delta\mathrm{Ln}(\mathrm{O})$	-12.89843***	-12.89843***	0.399693***	I(1)
$\mathrm{Ln}(S^*)$	-0.783808	-1.095552	0.647624*	
$\Delta\mathrm{Ln}(S^*)$	-12.09506***	-12.13271***	0.165228***	I(1)
Oman				
$\mathrm{Ln}(S)$	-1.407224	-1.020687	1.251882	
$\Delta\mathrm{Ln}(S)$	-5.556350***	-9.349460***	0.104119***	I(1)
$\mathrm{Ln}(\mathrm{M})$	-0.375539	-0.375187	1.624473	
$\Delta\mathrm{Ln}(\mathrm{M})$	-13.57031	-13.55383***	0.119519***	I(1)
$\mathrm{Ln}(\mathrm{I})$	-1.234779	-1.398947	1.096010	
$\Delta\mathrm{Ln}(\mathrm{I})$	-11.16534***	-11.14476***	0.050713***	I(1)
$\mathrm{Ln}(\mathrm{E})$	-1.475810	-1.012521	1.215717	
$\Delta\mathrm{Ln}(\mathrm{E})$	-3.566924***	-3.343665**	0.106808***	I(I)
$\mathrm{Ln}(\mathrm{C})$	1.596985	1.265053	1.585347	
$\Delta\mathrm{Ln}(\mathrm{C})$	-3.104533***	-13.32915***	0.517480**	I(1)
$\mathrm{Ln}(\mathrm{G})$	-1.382192	1.215510	1.479124	
$\Delta\mathrm{Ln}(\mathrm{G})$	-11.32958***	-9.526686***	0.129519***	I(1)
$\mathrm{Ln}(\mathrm{O})$	-1.180251	-1.283883	1.430914	
$\Delta\mathrm{Ln}(\mathrm{O})$	-10.00116***	-10.11491***	0.044369***	I(1)
$\mathrm{Ln}(S^*)$	-0.783808	-1.095552	0.647624*	
$\Delta\mathrm{Ln}(S^*)$	-12.09506	-12.13271***	0.165228***	I(1)

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively. Δ represents first difference.

Table 5.3: Continued

Macroeconomics Variables	ADF Test	PP Test	KPSS Test	Order of Integration
	H_0: Variable is non-stationary	H_0: Variable is non-stationary	H_0: Variable is stationary	
Qatar				
$\mathrm{Ln}(S)$	-1.760733	-1.727276	1.160081	
$\Delta\mathrm{Ln}(S)$	-10.96800***	-11.04145***	0.212096***	I(1)
$\mathrm{Ln}(M)$	0.852023	1.316591	1.144598	
$\Delta\mathrm{Ln}(M)$	-5.074944***	-11.89908***	0.994103***	I(1)
$\mathrm{Ln}(I)$	-1.534005	-1.839081	0.466162	
$\Delta\mathrm{Ln}(I)$	-18.92765	-19.11322***	0.099607***	I(1)
$\mathrm{Ln}(E)$	-3.566924	-3.347096	0.971288	
$\Delta\mathrm{Ln}(E)$	-12.29055***	-17.63567 ***	0.106746***	I(1)
$\mathrm{Ln}(C)$	-1.034362	-1.298565	0.657046*	
$\Delta\mathrm{Ln}(C)$	-11.61878***	-11.78723***	0.100600***	I(1)
$\mathrm{Ln}(G)$	-0.926663	0.566561	1.598875	
$\Delta\mathrm{Ln}(G)$	-5.334493	-2. 928076**	0.320019***	I(1)
$\mathrm{Ln}(O)$	-0.994167	-1.049988	1.536395	
$\Delta\mathrm{Ln}(O)$	-9.153725***	-9.153725***	0.042989***	I(1)
$\mathrm{Ln}(S^*)$	-0.783808	-1.095552	0.647624*	
$\Delta\mathrm{Ln}(S^*)$	-12.09506	-12.13271***	0.165228***	I(1)
UAE				
$\mathrm{Ln}(S)$	-1.728399	-1.744248	0.853068	
$\Delta\mathrm{Ln}(S)$	-9.980290***	-10.06151***	0.134155***	I(1)
$\mathrm{Ln}(M)$	-0.610827	-0.607400	1.563216	
$\Delta\mathrm{Ln}(M)$	-13.11961***	-13.12026***	0.118677***	I(1)
$\mathrm{Ln}(I)$	-1.579442	-1.689981	0.844563	
$\Delta\mathrm{Ln}(I)$	-14.33208***	-14.64871***	0.106370***	I(1)
$\mathrm{Ln}(E)$	-1.376321	-1.224310	1.541427	
$\Delta\mathrm{Ln}(E)$	-3.198712**	-4.443542***	0.653608**	I(1)
$\mathrm{Ln}(C)$	-2.187415	-2.368489	0.419122	
$\Delta\mathrm{Ln}(C)$	-12.45496***	-12.45840***	0.083328***	I(1)
$\mathrm{Ln}(G)$	-1.012666	-3.732349**	1.598089	
$\Delta\mathrm{Ln}(G)$	-2.974825**	-4.276660***	0.498303*	I(1)
$\mathrm{Ln}(O)$	-1.114211	-1.274423	1.433394	
$\Delta\mathrm{Ln}(O)$	-10.34583	-10.43421***	0.039384***	I(1)
$\mathrm{Ln}(S^*)$	-0.783808	-1.095552	0.647624*	
$\Delta\mathrm{Ln}(S^*)$	-12.09506	-12.13271***	0.165228***	I(1)
Asymptotic critical values				
1 per cent	-3.469933	-3.469691	0.739000	
5 per cent	-2.878829	-2.878723	0.463000	
10 per cent	-2.576067	-2.576010	0.347000	

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively. Δ represents first difference.

Figure 5.1: Kuwait Stock Prices

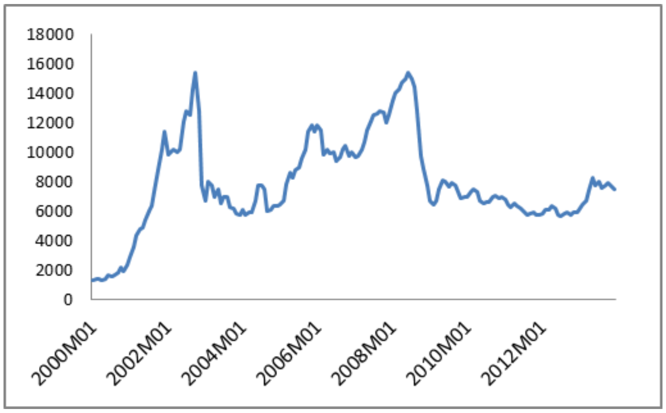


Figure 5.2: Kuwait Stock Prices in First Difference

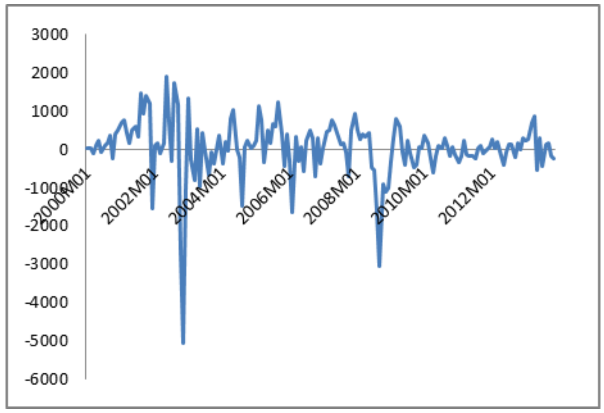


Figure 5.3: Kuwait Money Supply (KD Million)

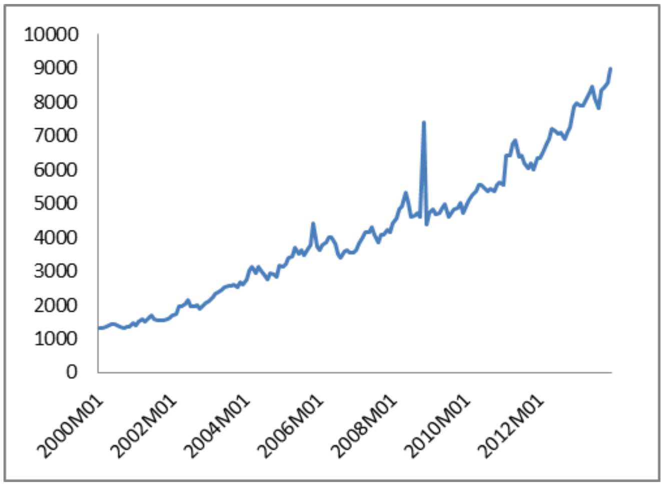


Figure 5.4: Kuwait Money Supply in First Difference

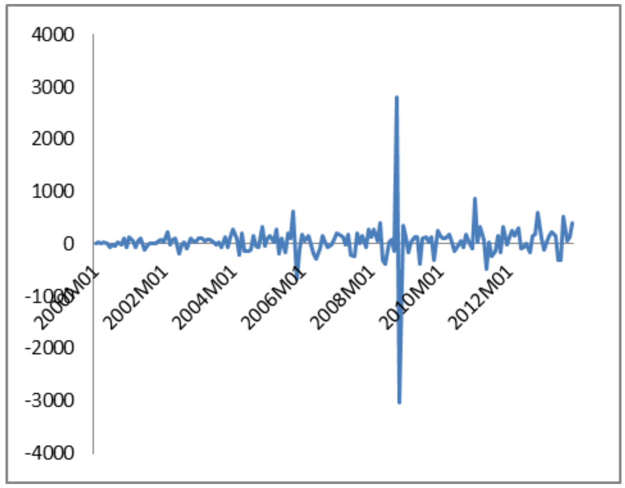


Figure 5.5: Kuwait Interest Rate (%)

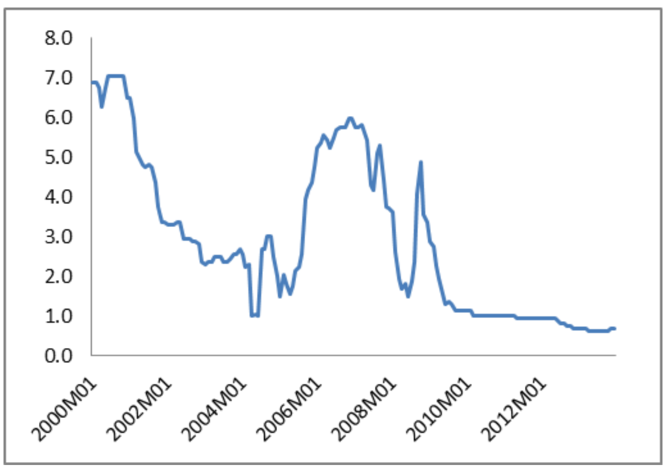


Figure 5.6: Kuwait Interest Rate in First Difference

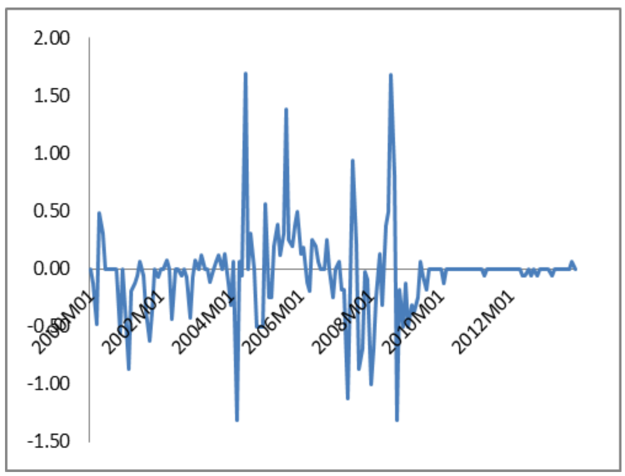


Figure 5.7: Kuwait Consumer Price Index

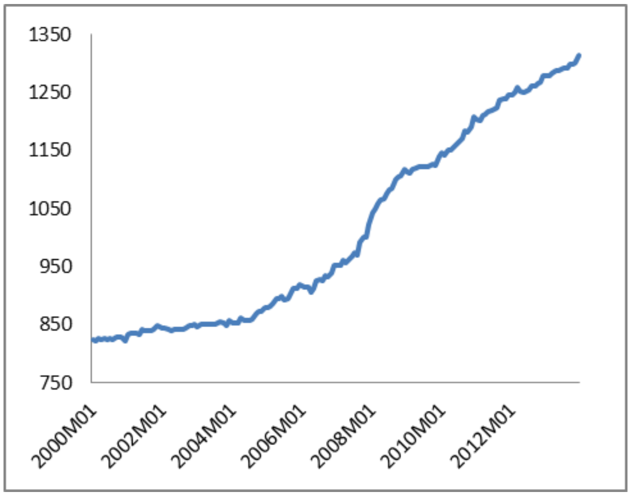


Figure 5.8: Kuwait Consumer Price Index in First Difference

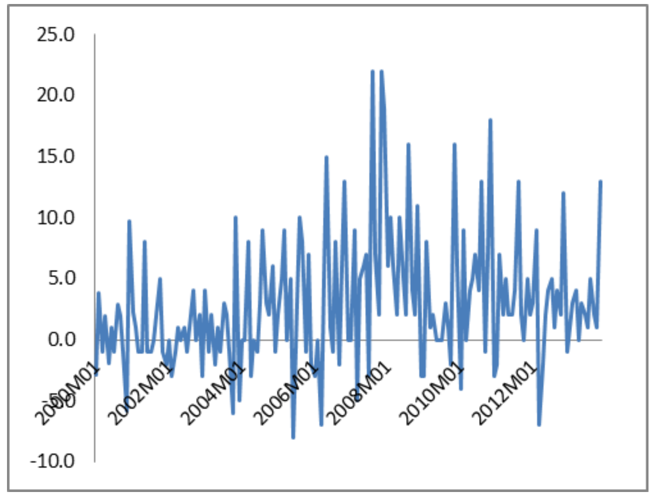


Figure 5.9: KWD/GBP

Figure 5.10: KWD/GBP in First Difference

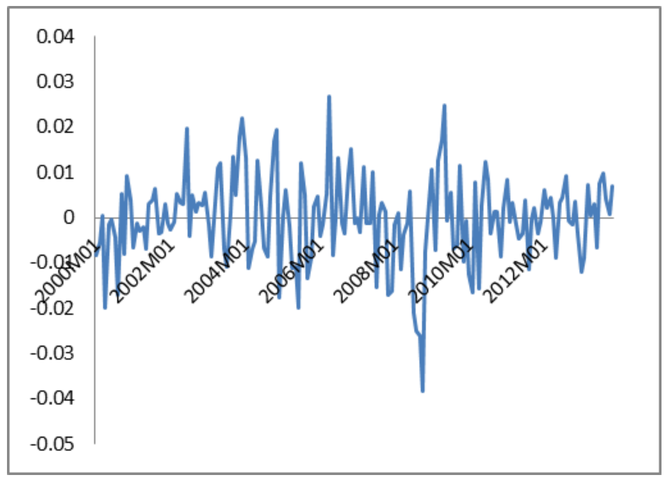


Figure 5.11: Kuwait Government Expenditure (KD Million)

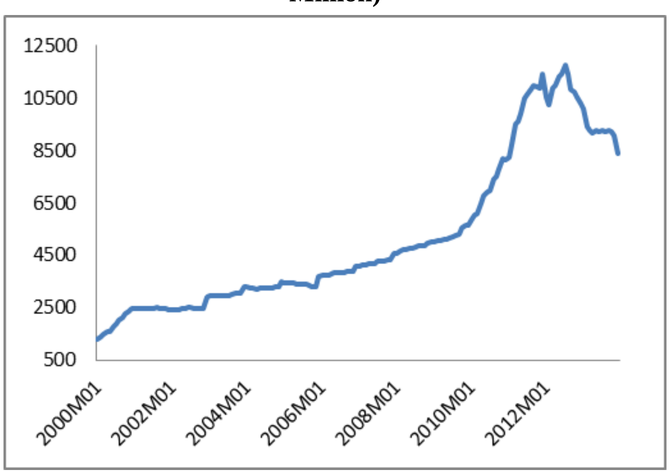


Figure 5.12: Kuwait Government Expenditure in First Difference

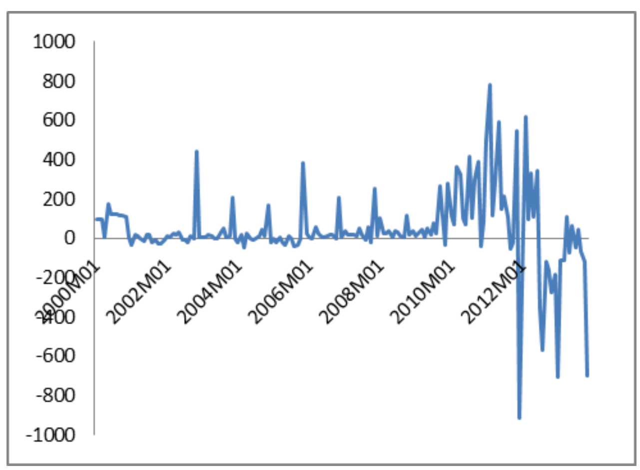


Figure 5.13: Kuwait Oil Revenue (KD million)

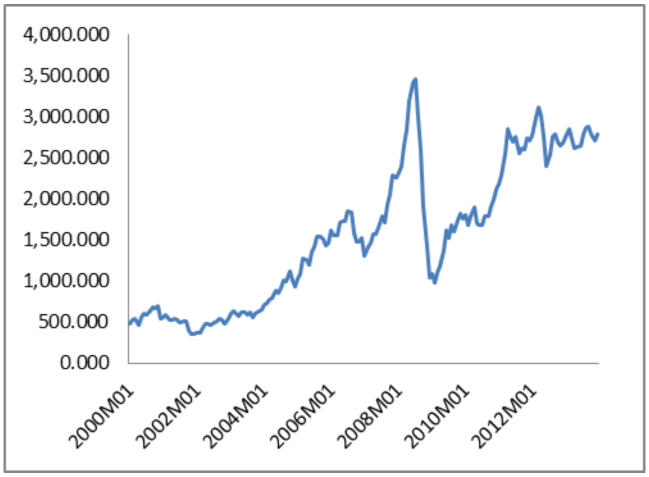


Figure 5.14: Kuwait Oil Revenue in First Difference

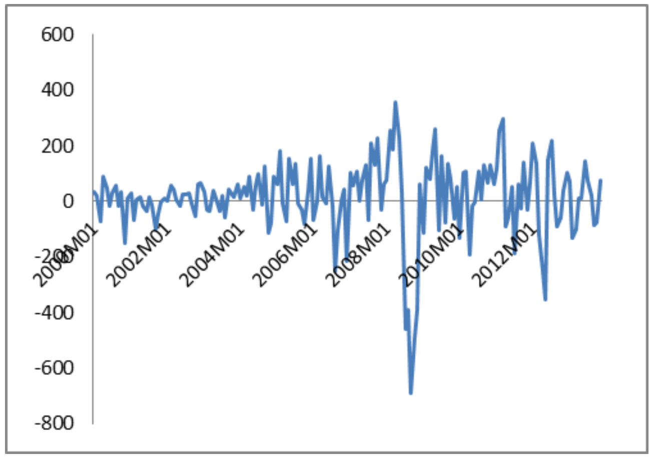


Figure 5.15: USA Stock Price

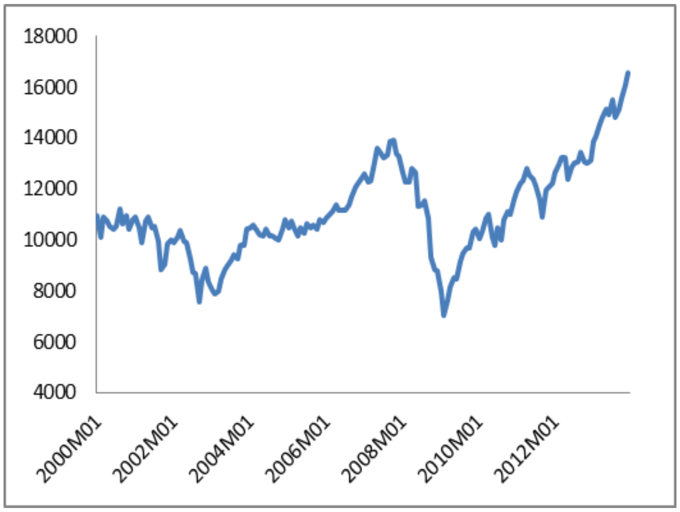


Figure 5.16: USA Stock Price Series in First Difference

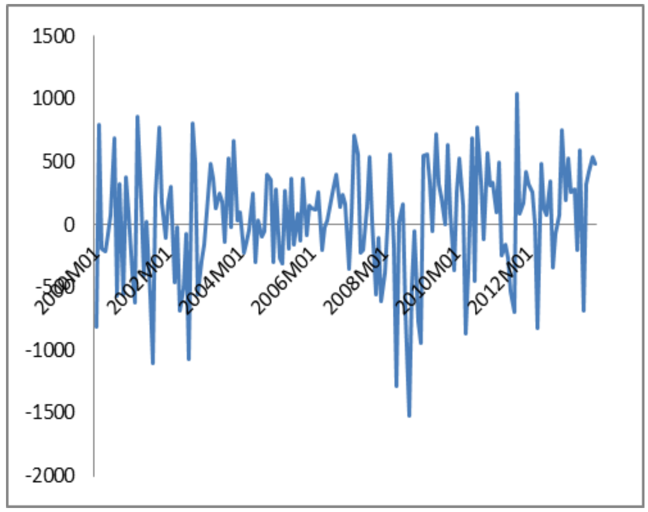


Figure 5.17: Saudi Stock Prices

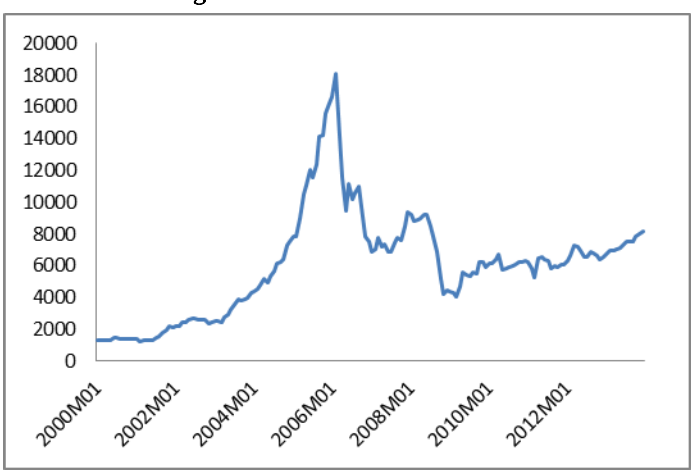


Figure 5.18: Saudi Stock Prices in First Difference

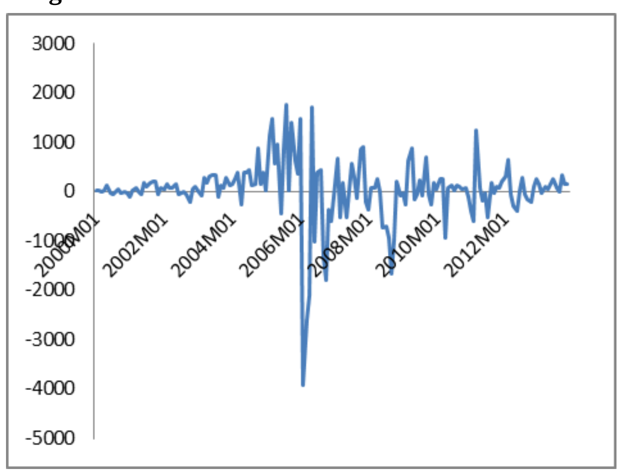


Figure 5.19: Saudi Money Supply (SAR Billion)

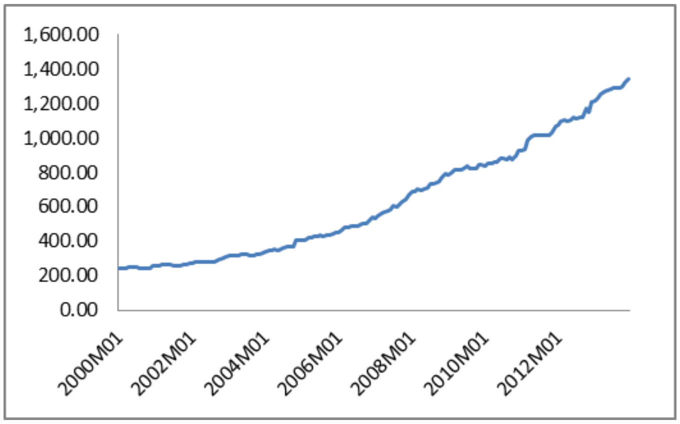


Figure 5.20: Saudi Money Supply in First Difference

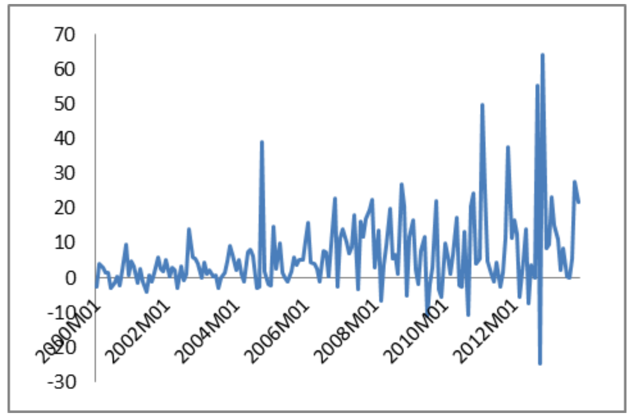


Figure 5.21: SAR/GBP

Figure 5.22: SAR/GBP in First Difference

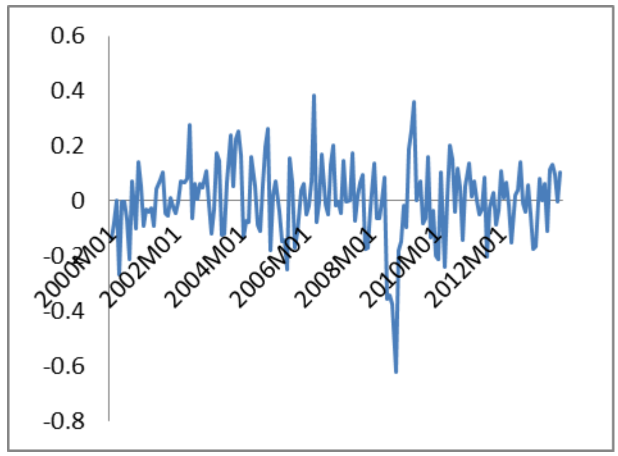


Figure 5.23: Saudi Government Expenditure (SAR)

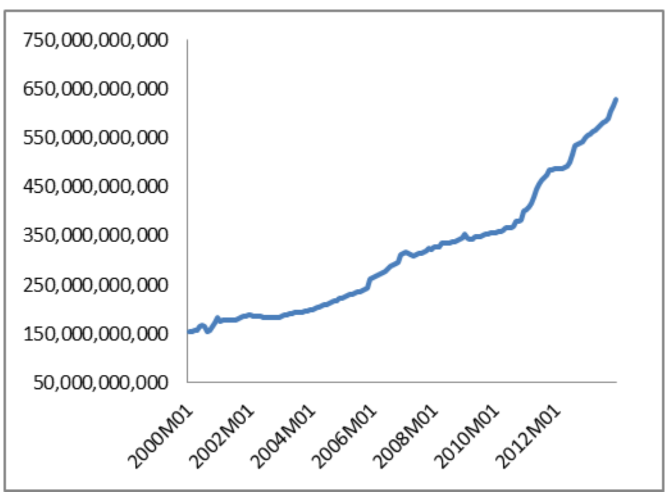


Figure 5.24: Saudi Government Expenditure in First Difference

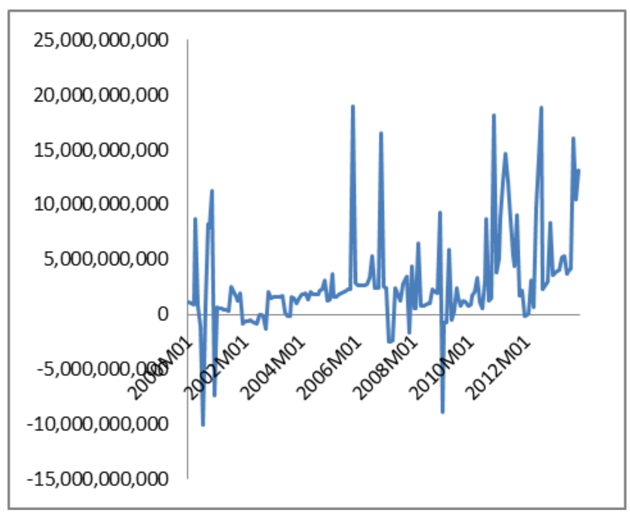


Figure 5.25: Saudi Consumer Price Index

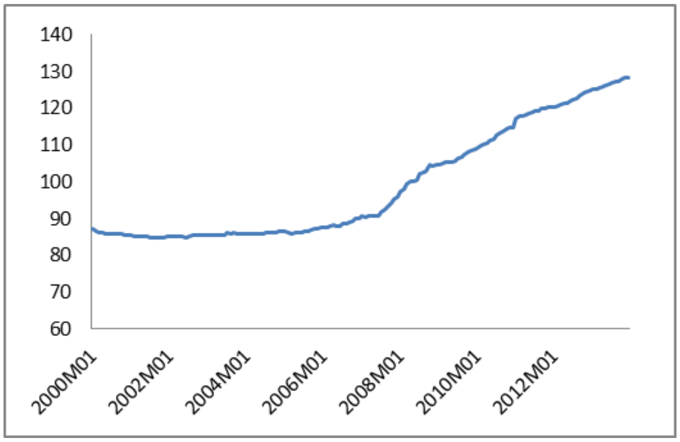


Figure 5.26: Saudi Consumer Price Index in First Difference

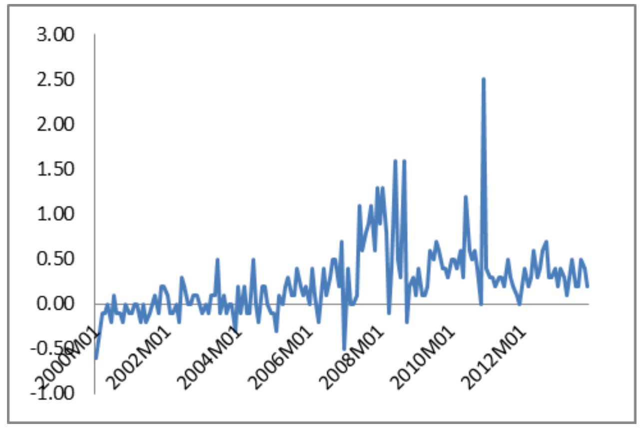


Figure 5.27: Saudi Oil Revenue (SAR)

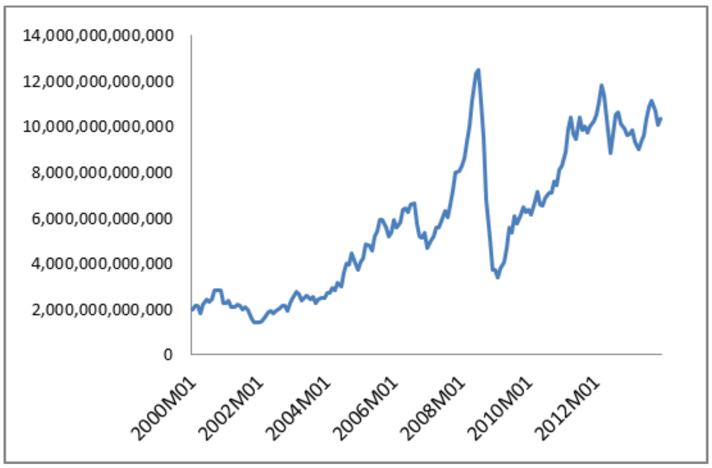


Figure 5.28: Saudi Oil Revenue Series in First Difference

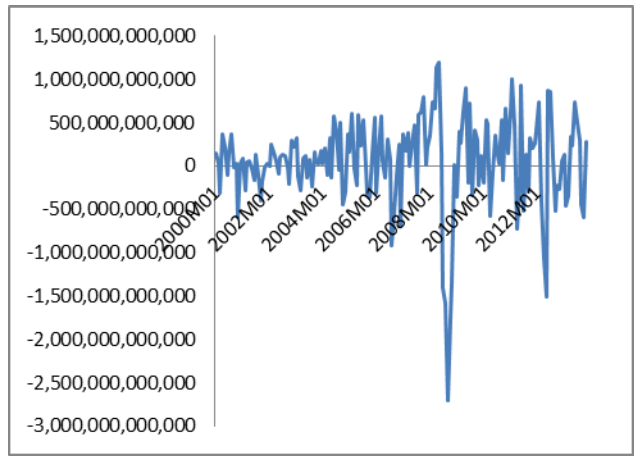


Figure 5.29: Saudi Interest Rate (%)

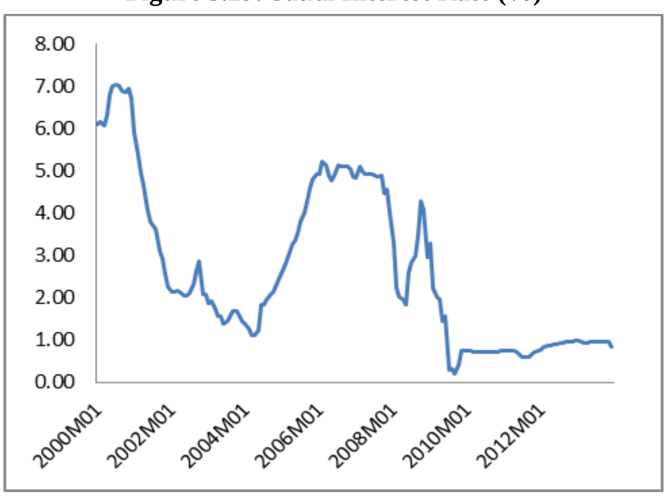


Figure 5.30: Saudi Interest Rate in First Difference

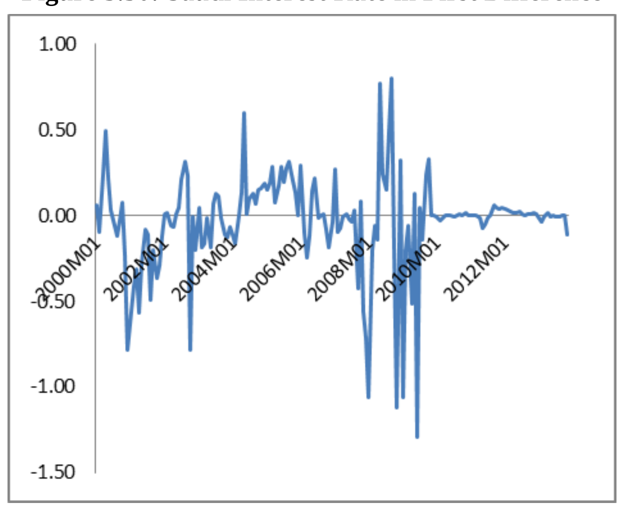


Figure 5.31: Bahrain Stock Prices

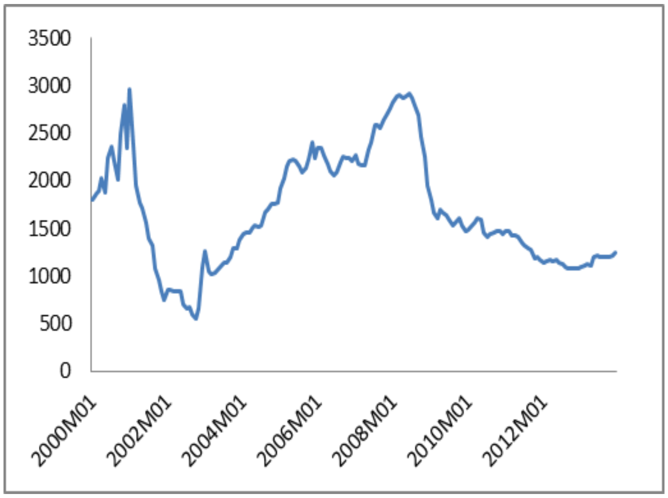


Figure 5.32: Bahrain Stock Price in First Difference

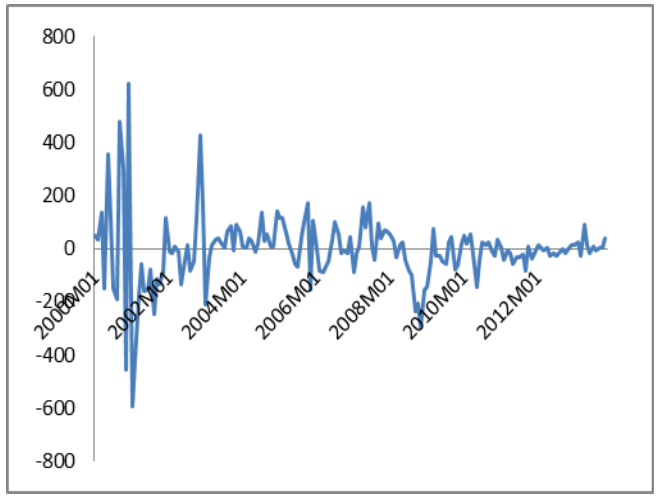


Figure 5.33: Bahrain Money Supply (BHD million)

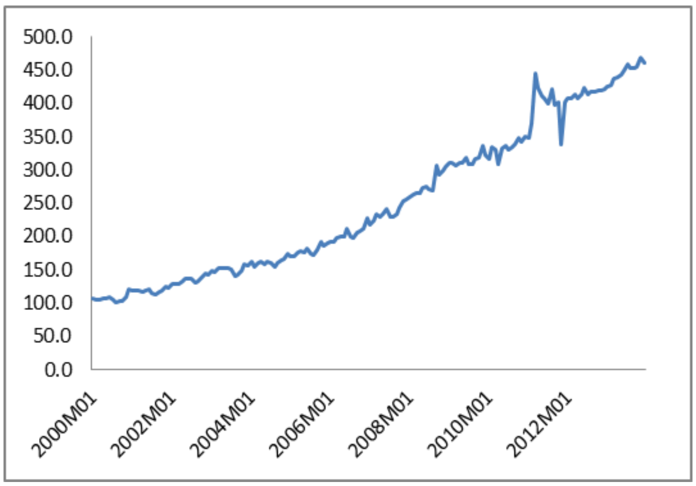


Figure 5.34: Bahrain Money Supply in First Difference

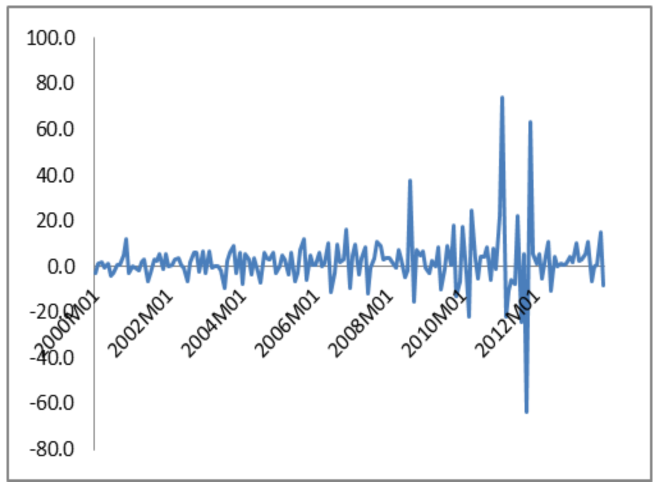


Figure 5.35: Bahrain Interest Rate (%)

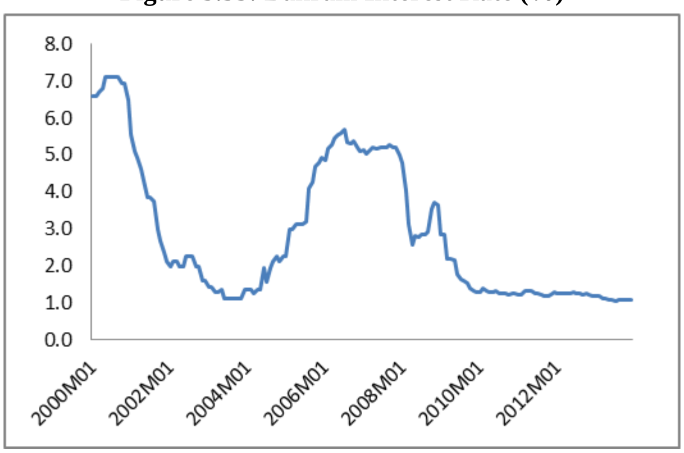


Figure 5.36: Bahrain Interest Rate in First Difference

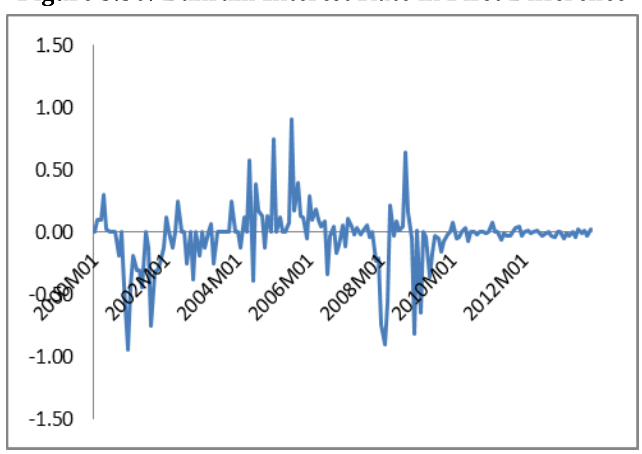


Figure 5.37: Bahrain Consumer Price Index

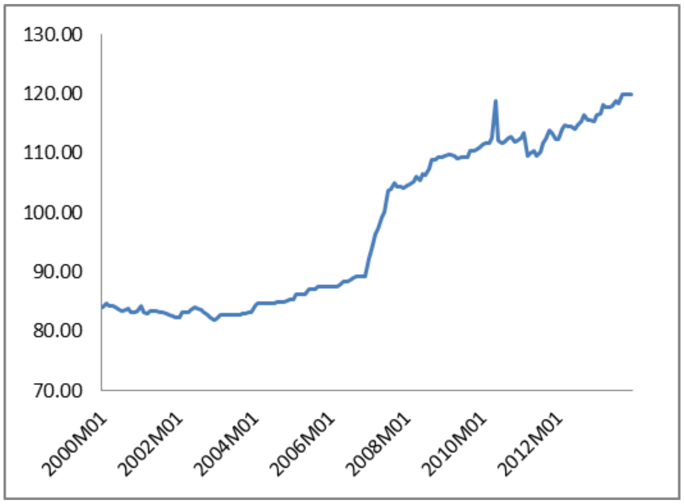


Figure 5.38: Bahrain Consumer Price Index in First Difference

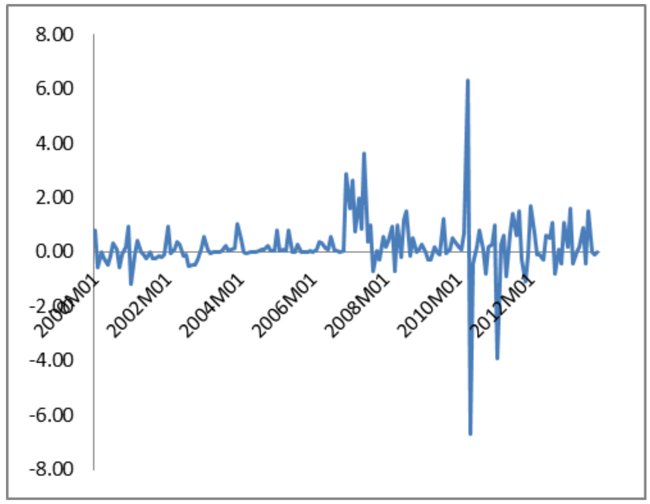


Figure 5.39: BHD/GBP

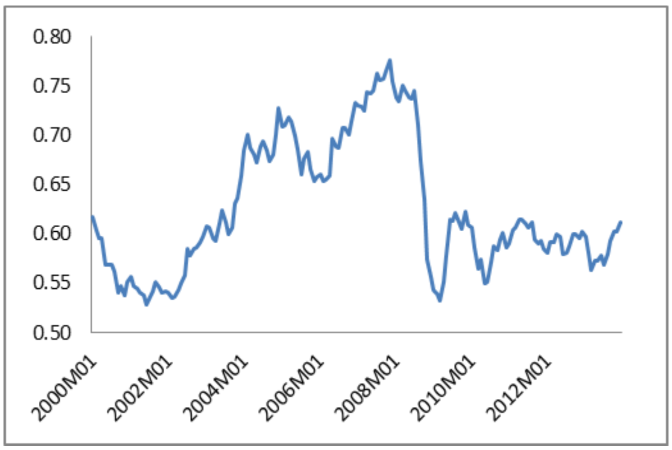


Figure 5.40: BHD/GBP in First Difference

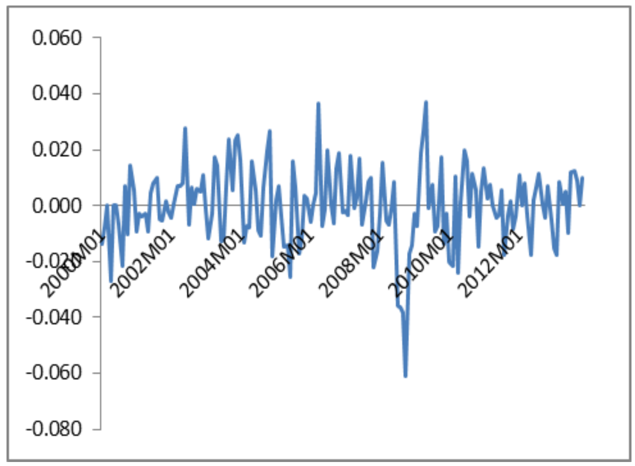


Figure 5.41: Bahrain Government Expenditure (BHD million)

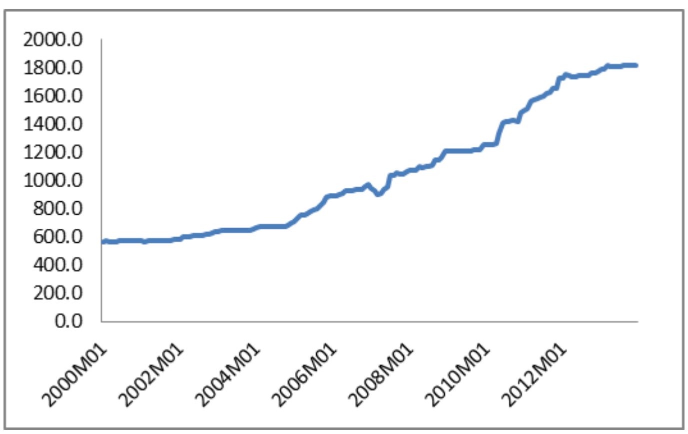


Figure 5.42: Bahrain Government Expenditure in First Difference

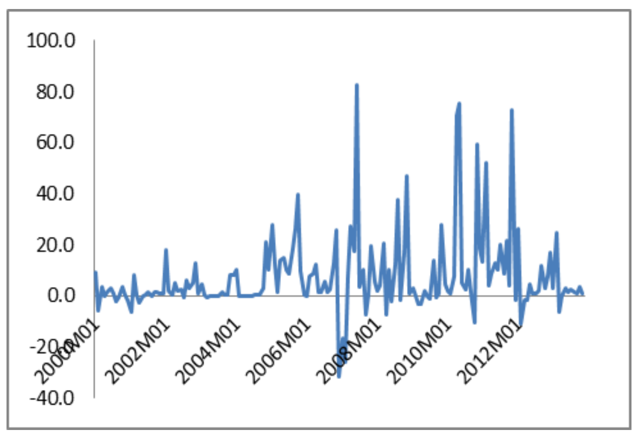


Figure 5.43: Bahrain Oil Revenue (BHD Million)

Figure 5.44: Bahrain Oil Revenue in First Difference

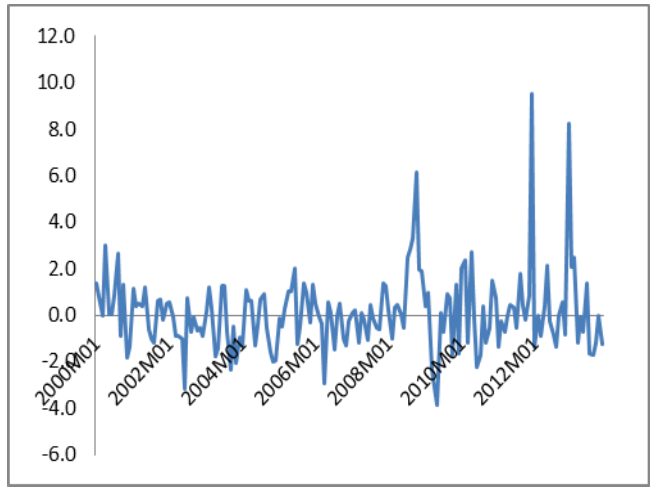


Figure 5.45: Oman Stock Series

Figure 5.46: Oman Stock Series in First Difference

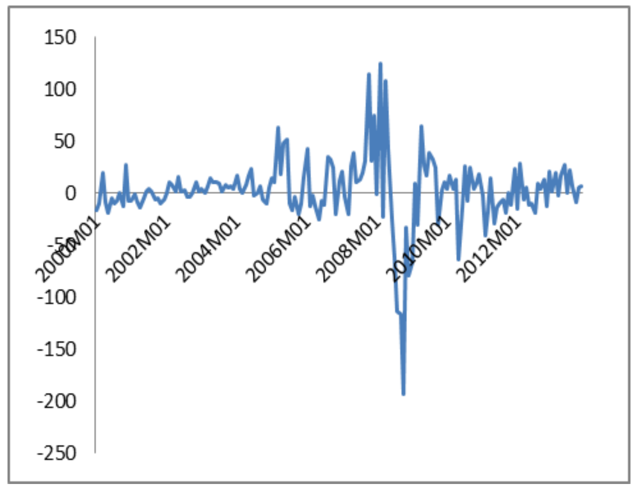


Figure 5.47: Oman Money (OMR Million)

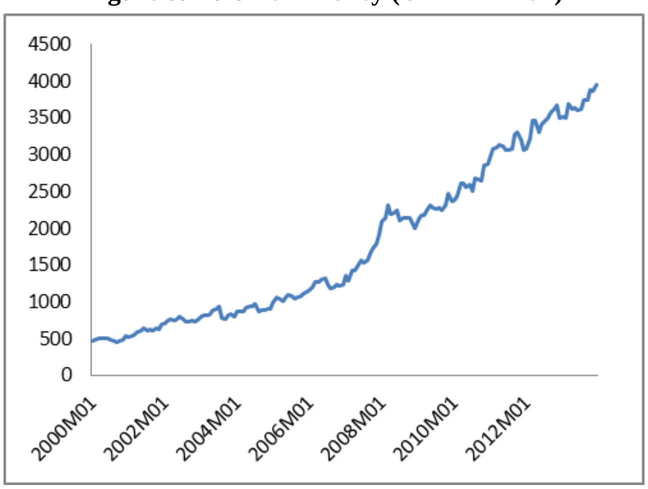


Figure 5.48: Oman Money Supply in First Difference

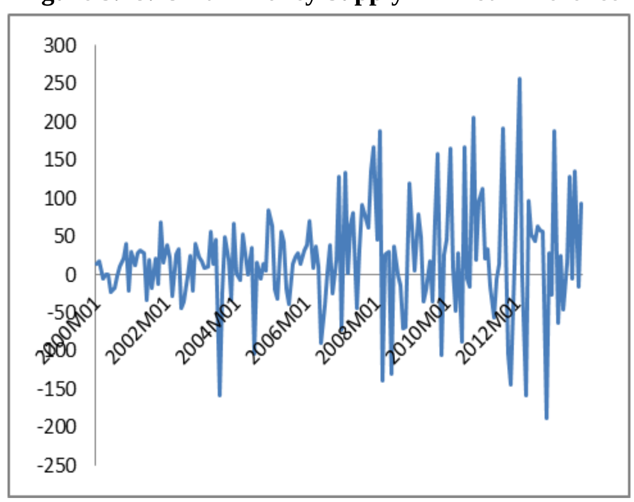


Figure 5.49: Oman Interest Rate (%)

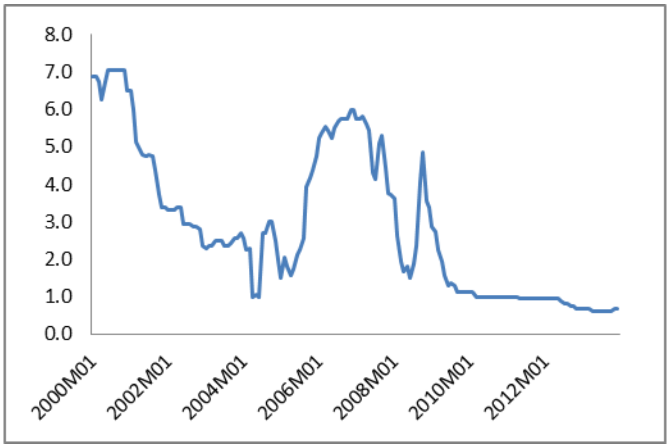


Figure 5.50: Oman Interest Rate in First Difference

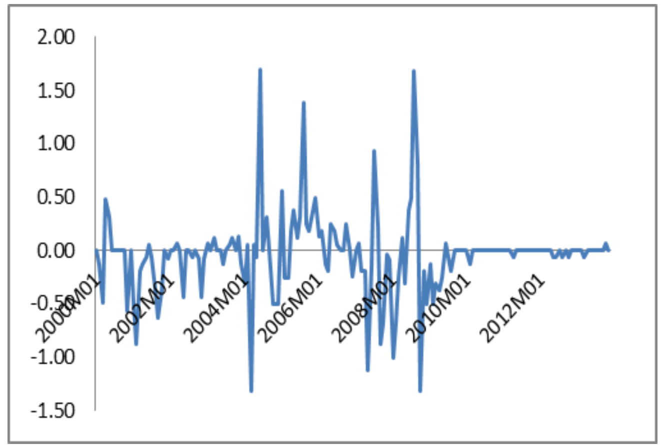


Figure 5.51: Oman Consumer Price Index

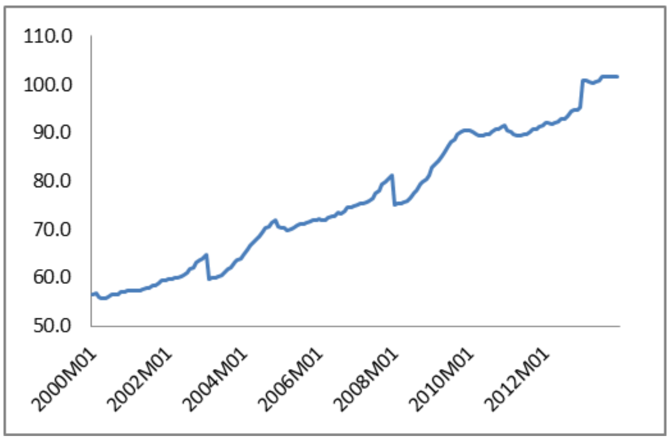


Figure 5.52: Oman Consumer Price Index in First Difference

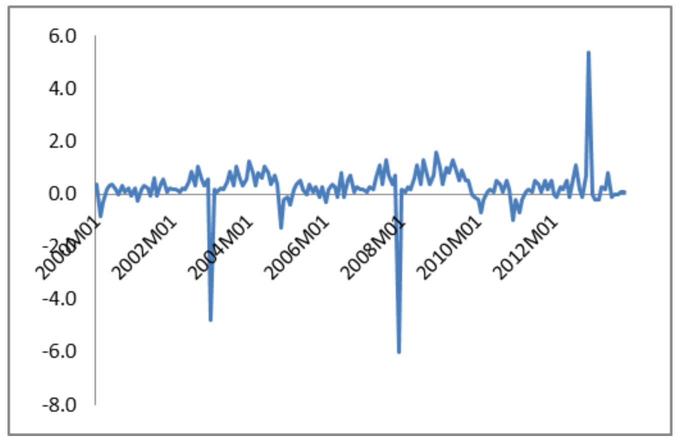


Figure 5.53: OMR/GBP

Figure 5.54: OMR/GBP in First Difference

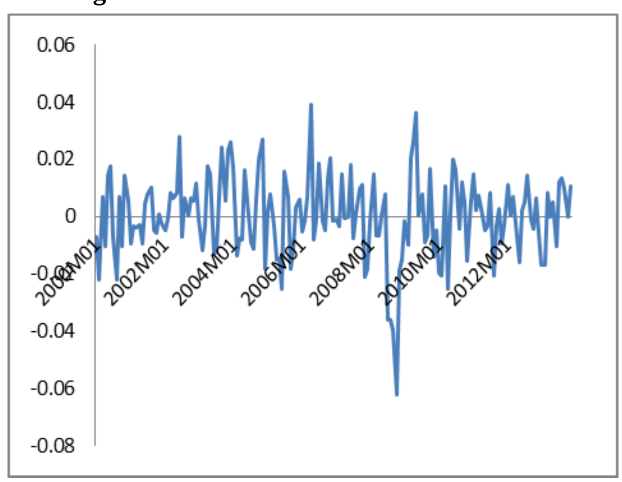


Figure 5.55: Oman Government Expenditure (OMR Million)

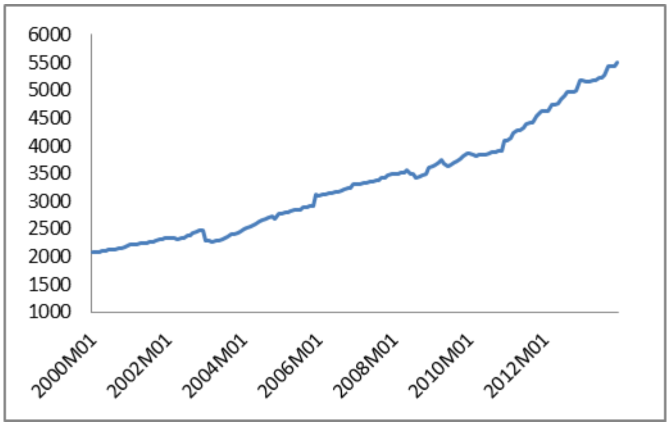


Figure 5.56: Oman Government Expenditure in First Difference

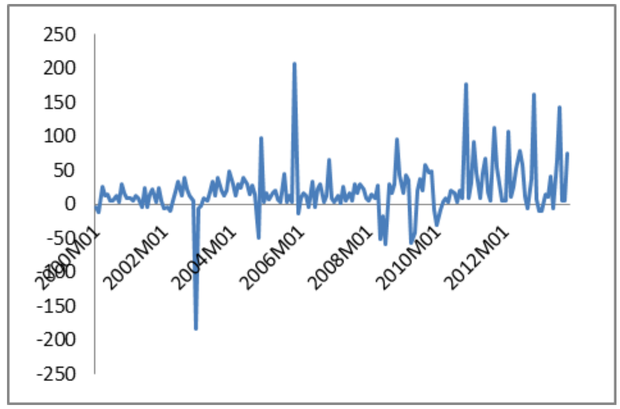


Figure 5.57: Oman Oil Revenue (OMR million)

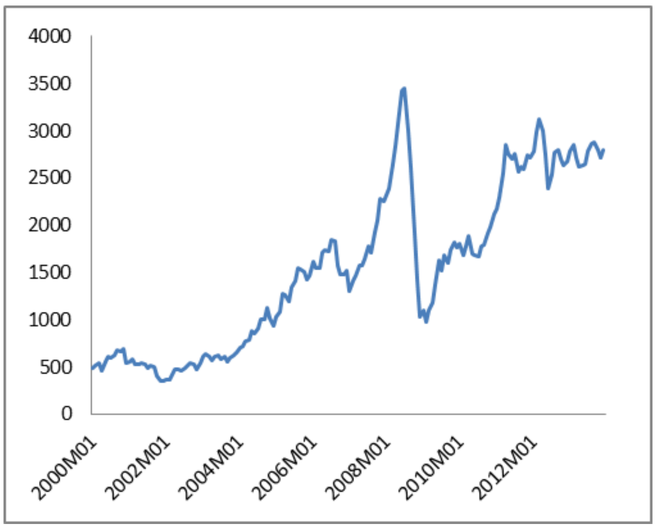


Figure 5.58: Oman Oil Revenue in First Difference

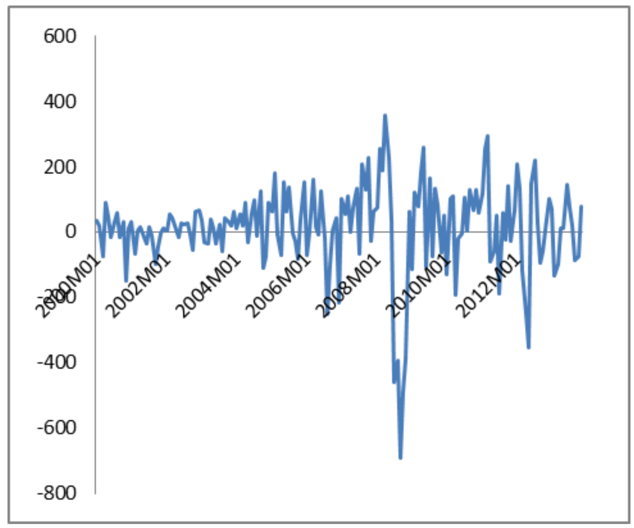


Figure 5.59: Qatar Stock Prices

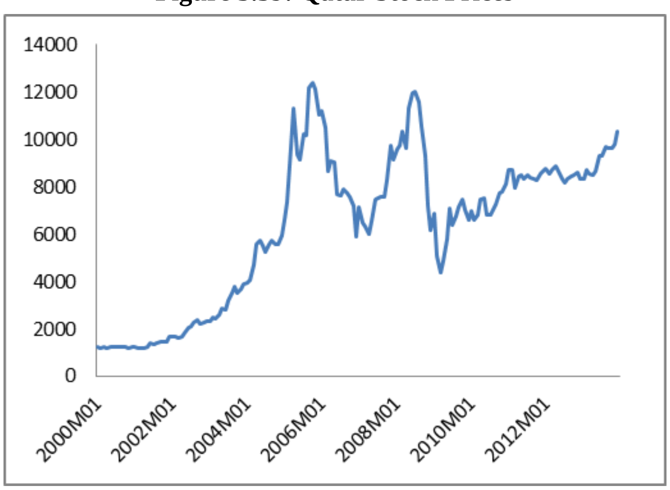


Figure 5.60: Qatar Stock Prices in First Difference

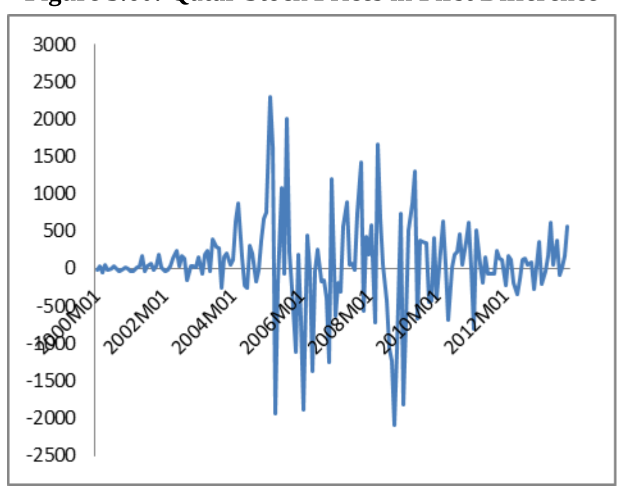


Figure 5.61: Qatar Money Supply (QAR Million)

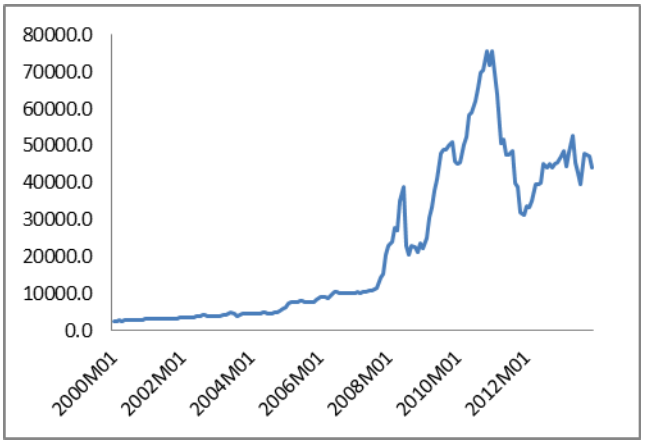


Figure 5.62: Qatar Money Supply in First Difference

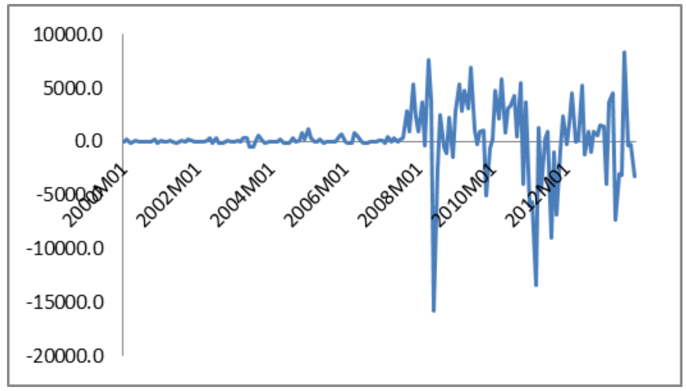


Figure 5.63: Qatar Interest Rate (%)

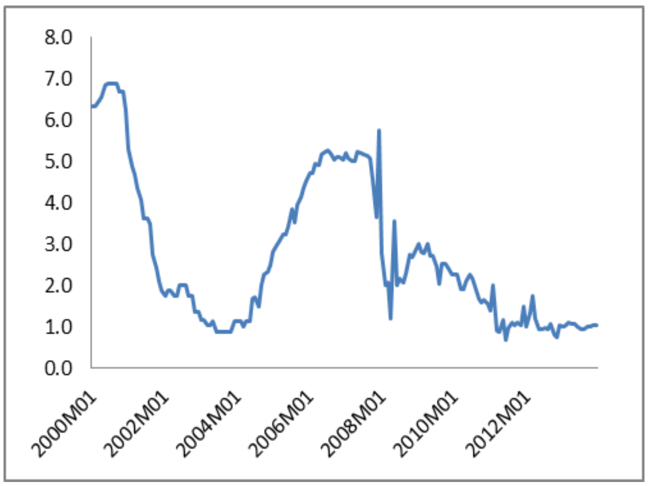


Figure 5.64: Qatar Interest Rate in First Difference

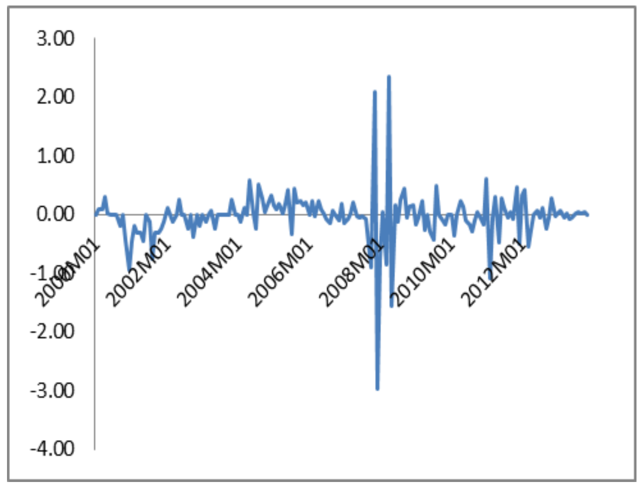


Figure 5.65: Qatar Consumer Price Index

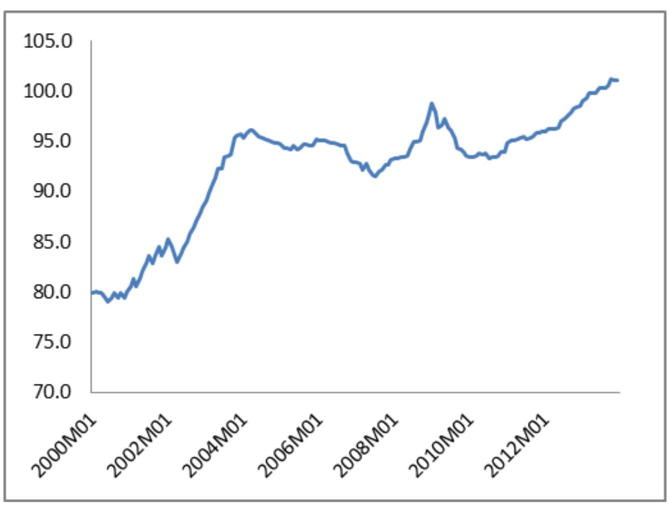


Figure 5.66: Qatar Consumer Price Index in First Difference

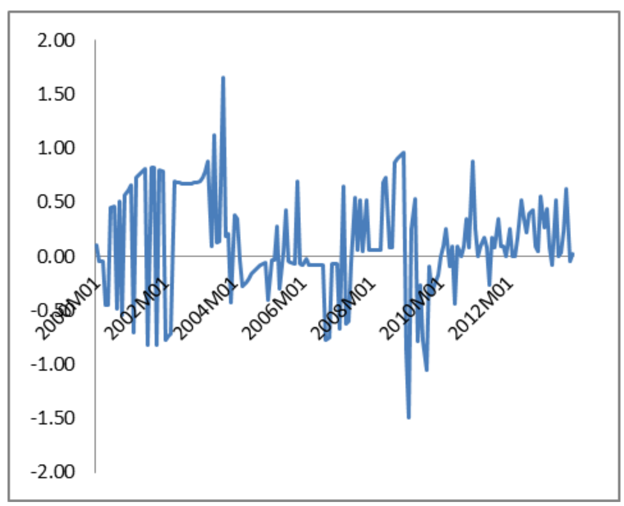


Figure 5.67: QAR/GBP

Figure 5.68: QAR/GBP in First Difference

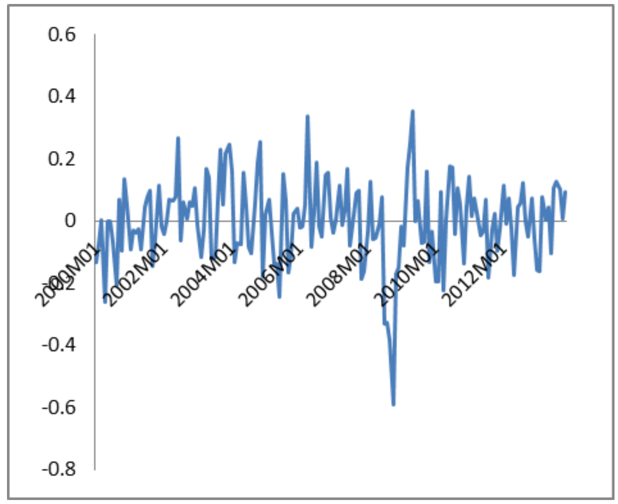


Figure 5.69: Qatar Government Expenditure (QAR Million)

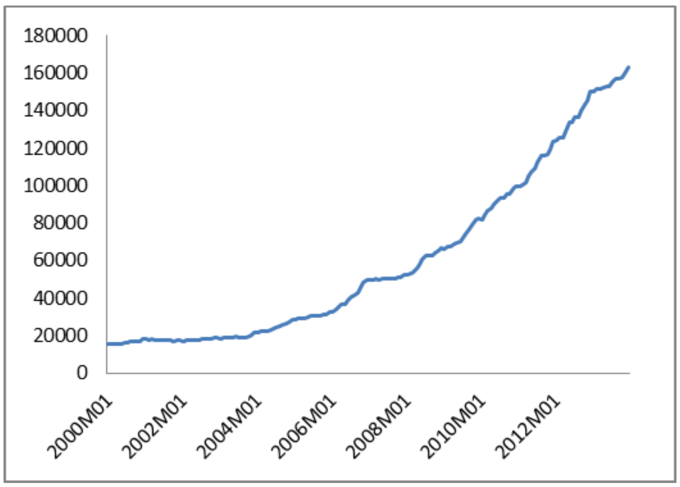


Figure 5.70: Qatar Government Expenditure in First Difference

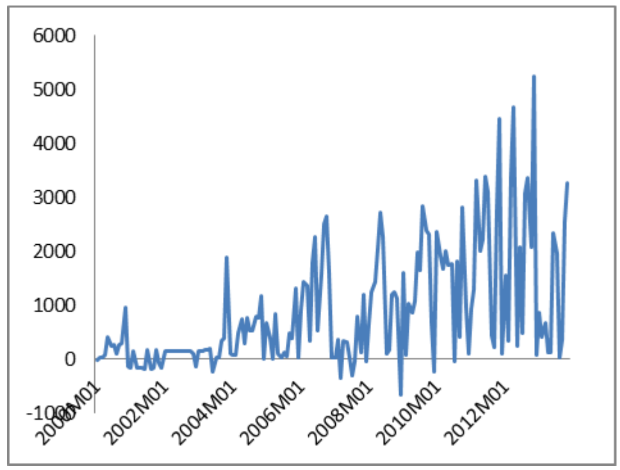


Figure 5.71: Qatar Oil Revenue (QAR Million)

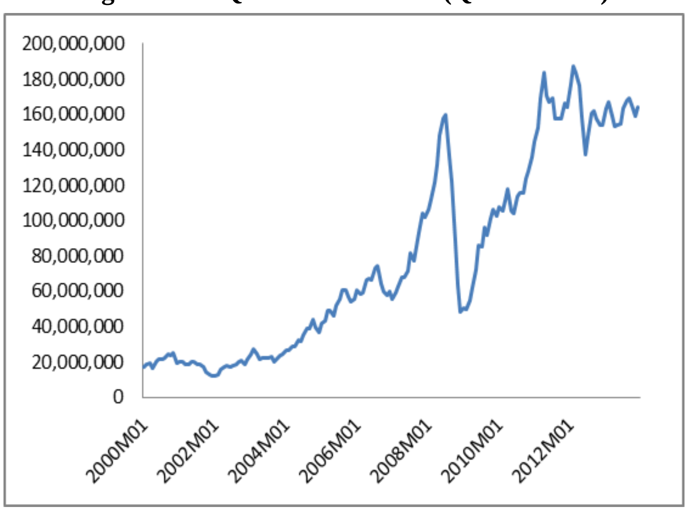


Figure 5.72: Qatar Oil Revenue in First Difference

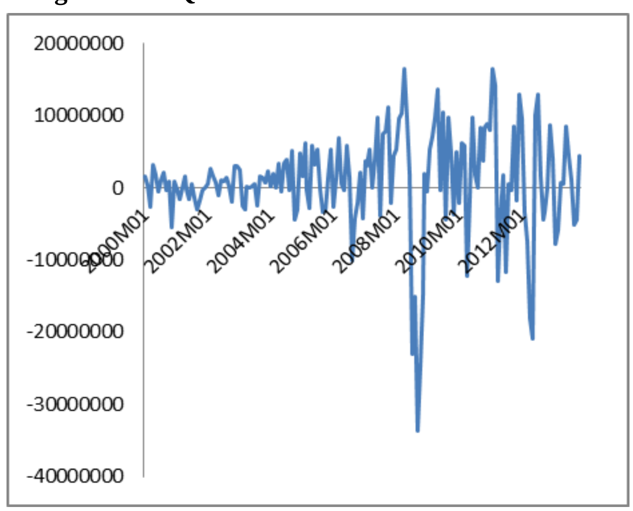


Figure 5.73: UAE Stock Prices

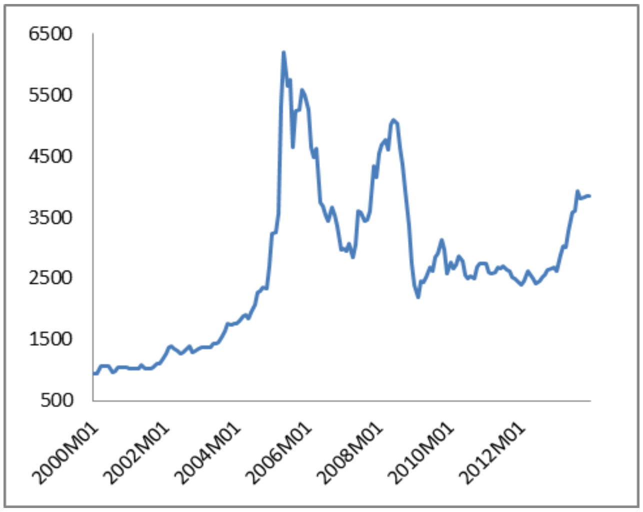


Figure 5.74: UAE Stock Prices in First Difference

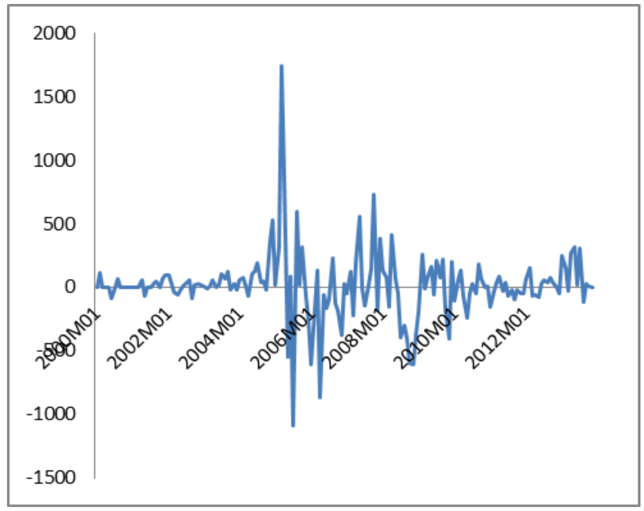


Figure 5.75: UAE Money Supply (AED Million)

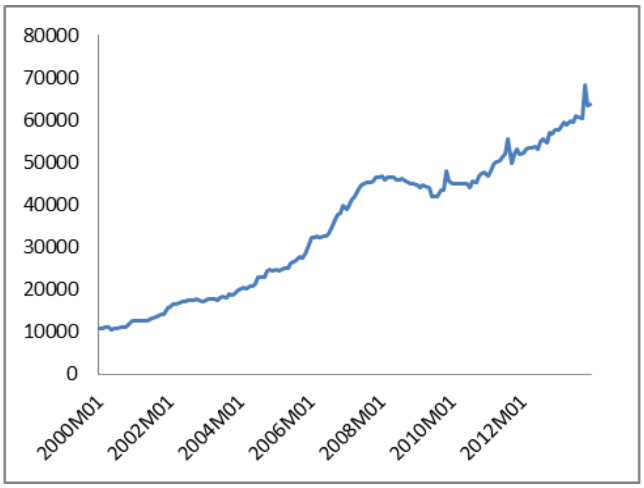


Figure 5.76: UAE Money Supply Series in First Difference

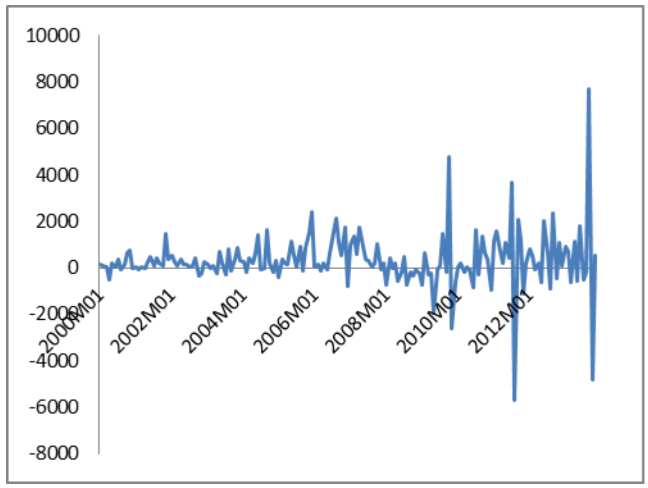


Figure 5.77: UAE Interest Rate (%)

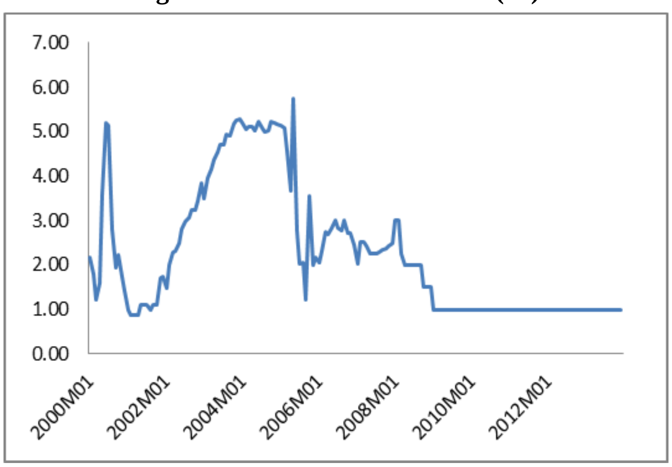


Figure 5.78: UAE Interest Rate in First Difference

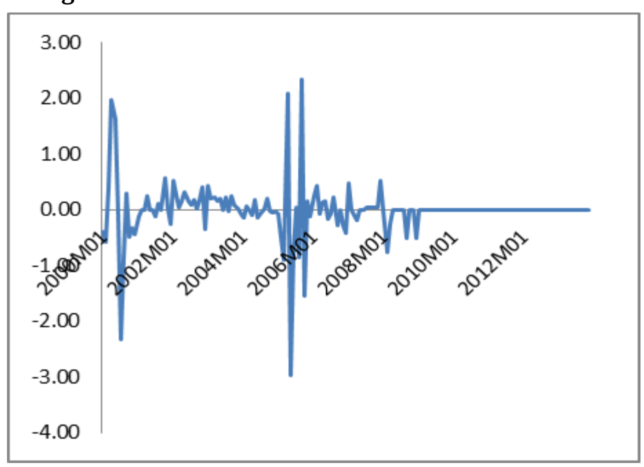


Figure 5.79: UAE Consumer Price Index

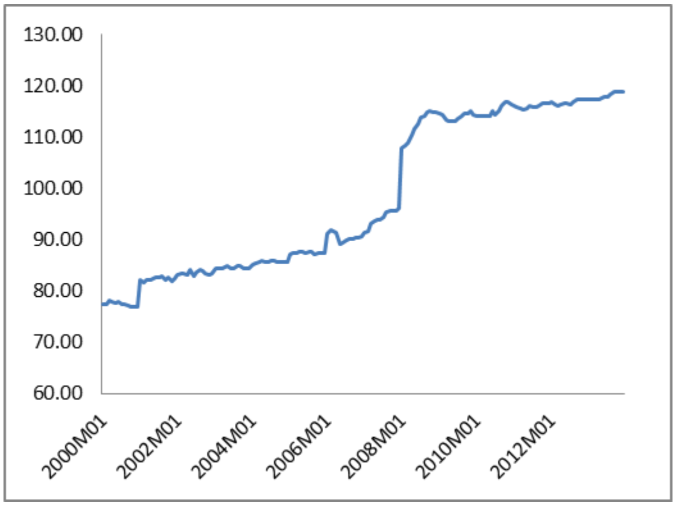


Figure 5.80: UAE Consumer Price Index in First Difference

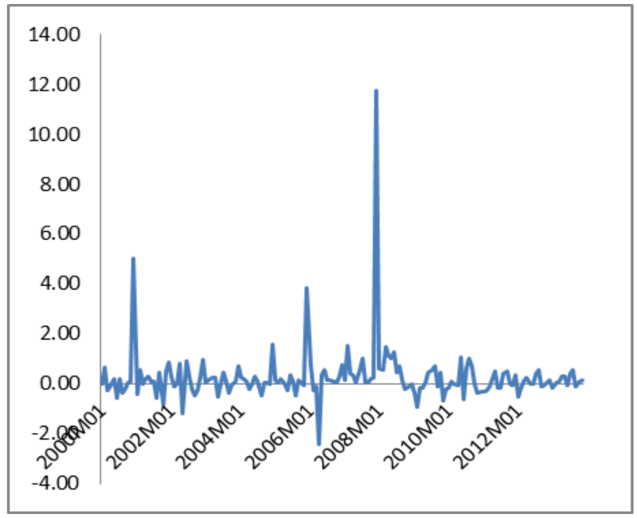


Figure 5.81: AED/GBP

Figure 5.82: AED/GBP in First Difference

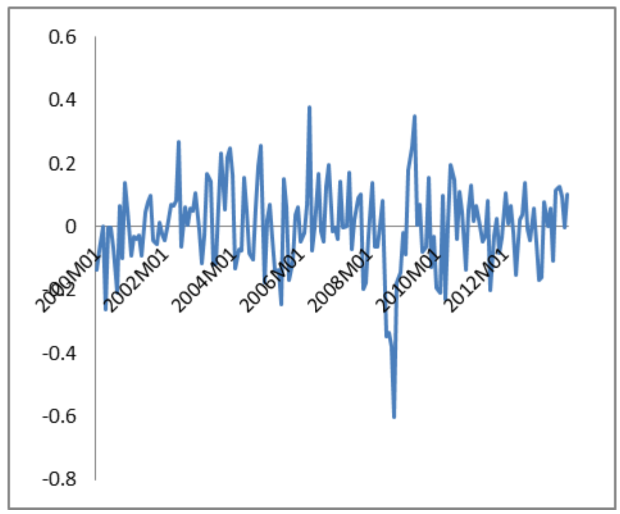


Figure 5.83: UAE Government Expenditure (AED Million)

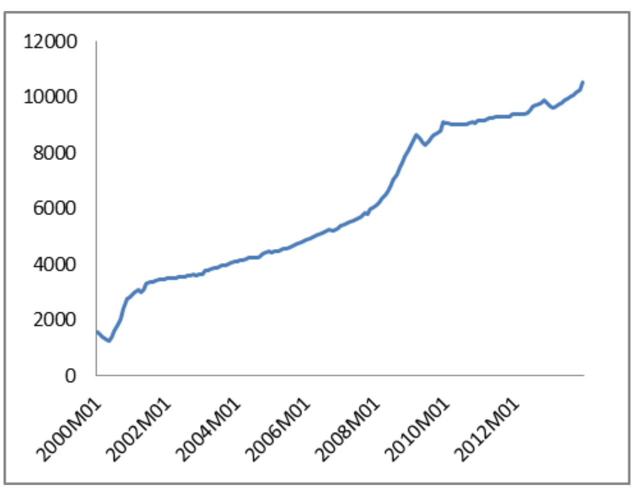


Figure 5.84: UAE Government Expenditure Series in First Difference

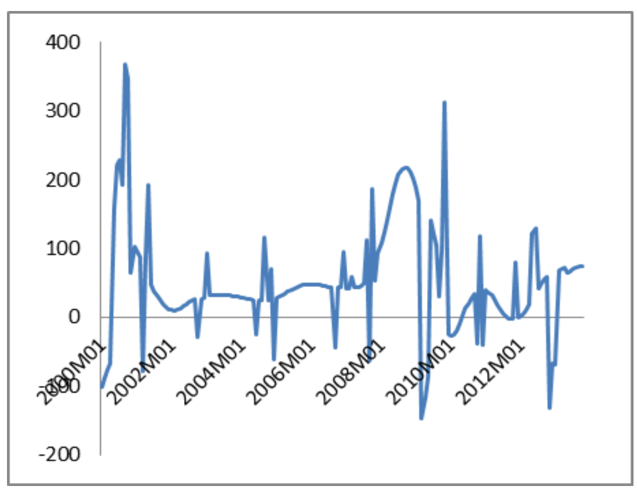


Figure 5.85: UAE Oil Revenue (AED)

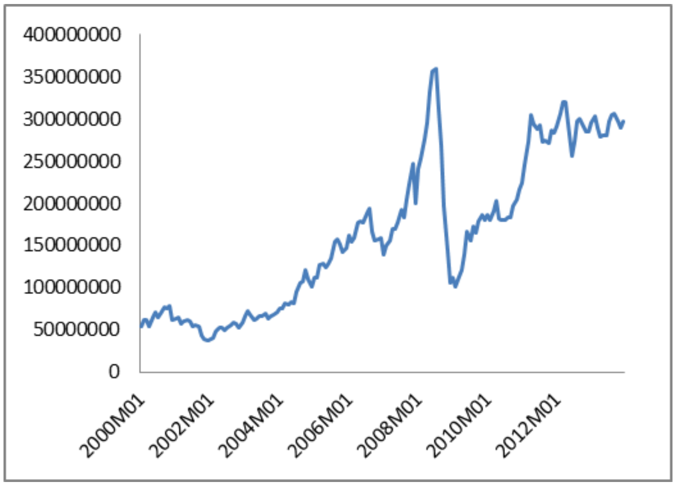
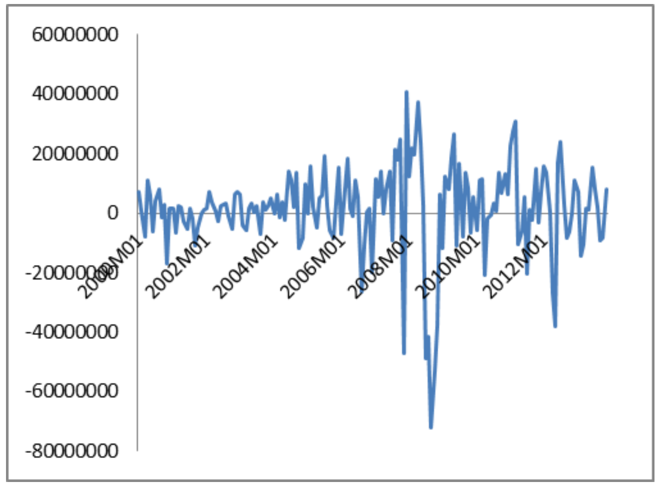


Figure 5.86: UAE Oil Revenue Series in First Difference



5.7 Optimal Lag Length Results

An appropriate lag length must be selected before applying the cointegration test. The cointegration regression is over-parameterised if the number of lags is too large, and it is misspecified if the number of lags is too small. This study applies lag-order selection-based information criteria such as the Schwarz Criterion (SC) and AIC. Table 5.4 displays the results.

Table 5.4: VAR-Lag-order Selection Criteria for Variables

	Log(L)	LR-Crit.	FPR	AIC- Crit.	SC_ Crit.	HQ- Crit.
Kuwait						
Lag(0)	765.5564	NA	9.45e-15	-9.589322	-9.434254	-9.526347
Lag(1)	2454.189	3184.890	1.11e-23	-30.15430	**-28.75868***	**-29.58752***
Lag(2)	2519.085	115.8260	**1.10e-23***	**-30.16563***	-27.52947	-29.09505
Lag(3)	2580.283	103.0293	1.16e-23	-30.13016	-26.25346	-28.55578
Lag(4)	2640.045	94.56093	1.26e-23	-30.07652	-24.95927	-27.99834
Lag(5)	2681.058	60.74045	1.76e-23	-29.78554	-23.42775	-27.20356
Lag(6)	2730.133	67.71066	2.29e-23	-29.59662	-21.99828	-26.51084
Lag(7)	2795.597	83.69454	2.49e-23	-29.61515	-20.77627	-26.02557
Lag(8)	2867.963	**85.19081***	2.58e-23	-29.72105	-19.64163	-25.62767
Lag(9)	2940.607	78.16157	2.81e-23	-29.83047	-18.51050	-25.23329
Lag(10)	3017.350	74.79945	3.08e-23	-29.99177	-17.43125	-24.89078
KSA						
Lag(0)	1005.844	NA	4.52e-16	-12.63094	-12.47587	-12.56796
Lag(1)	2902.357	3576.968	3.81e-26	-35.82731	**-34.43169***	**-35.26053***
Lag(2)	2975.323	130.2294	3.42e-26	-35.94079	-33.30463	-34.87021
Lag(3)	3040.553	109.8185	3.42e-26	-35.95637	-32.07967	-34.38199
Lag(4)	3136.368	151.6053	2.35e-26	-36.35908	-31.24184	-34.28091
Lag(5)	3208.513	106.8475	2.22e-26	-36.46218	-30.10439	-33.88020
Lag(6)	3261.773	73.48556	2.74e-26	-36.32624	-28.72790	-33.24046
Lag(7)	3315.723	68.97420	3.45e-26	-36.19902	-27.36014	-32.60944
Lag(8)	3405.799	106.0393	2.86e-26	-36.52910	-26.44968	-32.43572
Lag(9)	3505.395	107.1596	2.20e-26	-36.97968	-25.65971	-32.38250
Lag(10)	3597.370	**89.64722***	**1.99e-26***	**-37.33380***	-24.77329	-32.23282
Bahrain						
Lag(0)	1526.321	NA	6.21e-19	-19.21925	-19.06418	-19.15627
Lag(1)	3386.633	3508.691	8.29e-29	-41.95738	-40.56177	-41.39061
Lag(2)	3659.951	487.8203	**5.90e-30***	**-44.60697***	**-41.97082***	**-43.53640***
Lag(3)	3706.769	78.81972	7.44e-30	-44.38948	-40.51277	-42.81510
Lag(4)	3758.007	81.07367	8.99e-30	-44.22794	-39.11069	-42.14976
Lag(5)	3818.627	89.77827	9.84e-30	-44.18515	-37.82736	-41.60317
Lag(6)	3865.996	65.35706	1.31e-29	-43.97463	-36.37629	-40.88885
Lag(7)	3930.724	82.75418	1.43e-29	-43.98385	-35.14497	-40.39427
Lag(8)	3987.765	67.14906	1.80e-29	-43.89576	-33.81633	-39.80237
Lag(9)	4058.426	76.02818	2.01e-29	-43.98008	-32.66011	-39.38290
Lag(10)	4158.979	**98.00743***	1.63e-29	-44.44278	-31.88226	-39.34179
Lag(0)	1526.321	NA	6.21e-19	-19.21925	-19.06418	-19.15627
Oman						
Lag(0)	1231.796	NA	2.59e-17	-15.49108	-15.33602	-15.42811
Lag(1)	2815.011	2986.064	**1.15e-25***	**-34.72166***	**-33.32604***	**-34.15488***
Lag(2)	2874.332	105.8775	1.23e-25	-34.66243	-32.02628	-33.59186
Lag(3)	2938.019	107.2194	1.25e-25	-34.65847	-30.78177	-33.08409
Lag(4)	2988.621	80.06651	1.53e-25	-34.48887	-29.37163	-32.41070
Lag(5)	3032.372	64.79612	2.07e-25	-34.23256	-27.87477	-31.65058
Lag(6)	3082.514	69.18312	2.65e-25	-34.05714	-26.45880	-30.97136
Lag(7)	3142.983	77.30889	3.07e-25	-34.01245	-25.17357	-30.42287
Lag(8)	3203.545	71.29415	3.70e-25	-33.96893	-23.88950	-29.87554
Lag(9)	3260.836	61.64165	4.87e-25	-33.88400	-22.56402	-29.28681
Lag(10)	3352.607	**89.44815***	4.41e-25	-34.23553	-21.67502	-29.13455

Table 5.4: Continued

	Log(L)	LR-Crit.	FPR	AIC- Crit.	SC_ Crit.	HQ- Crit.
Qatar						
Lag(0)	922.8113	NA	1.29e-15	-11.57989	-11.42482	-11.51692
Lag(1)	2998.961	3915.776	1.12e-26	-37.05014	-35.65453	-36.48337
Lag(2)	3377.631	675.8532	2.10e-28	-41.03330	-38.39714	-39.96272
Lag(3)	3680.660	510.1634	1.04e-29*	-44.05899	**-40.18229***	**-42.48461***
Lag(4)	3738.992	92.29719	1.14e-29	-43.98724	-38.86999	-41.90906
Lag(5)	3775.921	54.69250	1.69e-29	-43.64457	-37.28678	-41.06259
Lag(6)	3823.603	65.78915	2.23e-29	-43.43801	-35.83968	-40.35223
Lag(7)	3878.942	70.74913	2.76e-29	-43.32837	-34.48949	-39.73879
Lag(8)	3958.112	93.20090	2.63e-29	-43.52041	-33.44098	-39.42703
Lag(9)	4030.645	78.04112	2.86e-29	-43.62841	-32.30844	-39.03123
Lag(10)	4128.990	**95.85541***	2.38e-29	**-44.06316***	-31.50264	-38.96218
UAE						
Lag(0)	1195.784	NA	4.08e-17	-15.03524	-14.88017	-14.97226
Lag(1)	2996.885	3397.014	1.15e-26	-37.02386	-35.62825	-36.45709
Lag(2)	3390.622	702.7459	1.78e-28	-41.19775	-38.56159	-40.12717
Lag(3)	3691.325	506.2455	**9.04e-30***	**-44.19398***	**-40.31728***	**-42.61960***
Lag(4)	3736.017	70.71658	1.19e-29	-43.94959	-38.83234	-41.87141
Lag(5)	3789.093	78.60580	1.43e-29	-43.81131	-37.45351	-41.22933
Lag(6)	3828.982	55.03642	2.09e-29	-43.50610	-35.90776	-40.42032
Lag(7)	3879.396	64.45357	2.75e-29	-43.33413	-34.49525	-39.74455
Lag(8)	3952.298	**85.82065***	2.83e-29	-43.44680	-33.36738	-39.35342
Lag(9)	3996.576	47.64168	4.40e-29	-43.19717	-31.87720	-38.59999
Lag(10)	4069.941	71.50704	5.03e-29	-43.31570	-30.75519	-38.21472

Notes: LR-Crit. is sequential modified LR-Crit. statistic at the 5 per cent level; FPE implies final prediction error; AIC-Crit. is Akaike information criterion; SC-Crit. is Schwarz information criterion; HQ-Crit. is Hannan-Quinn information criterion.* shows lag order selected by the criterion.

5.8 Cointegration and Error Correction Model Results

After testing for stationarity, the second step is cointegration analysis. In this section, two methods will be used to test for cointegration: the residual-based test and the error correction test.

5.8.1 Bivariate Cointegration Analysis: Residual-based Method

For residual-based bivariate cointegration analysis, Equation (5.12) is estimated, and the residual is extracted and tested for the unit root by using the ADF statistic only. Table 5.5

shows the ADF statistics corresponding to the maximum AIC as shown in Table 5.4. Very few cases show cointegration.

Table 5.5: Results of Testing Bivariate Cointegration: Residual-based Method

	M ADF	I ADF	E ADF	P ADF	G ADF	O ADF	S^* ADF
Kuwait stock prices	-0.8953	-2.84601	-3.3157**	-1.1213	-1.2510	-2.3749	-2.1694
Saudi stock prices	-1.8900	-1.8779	-1.7951	-1.8936	-1.82074	-3.0395*	-1.9226
Bahrain stock prices	-1.3961	-2.4876	-3.7268*	-1.3685	-1.4345	-1.5886	-1.2028
Oman stock prices	-3.1360**	-2.1013	-0.3461	-2.9321**	-1.8587	-1.6409	-1.4526
Qatar stock prices	-1.7943	-1.3515	-0.7334	-1.6391	-1.8182	-1.8551	-2.2141
UAE stock prices	-1.9651	-1.9349	-1.4742	-1.8963	-1.9131	-1.7354	-1.9469

Note: M is money supply, I is interest rate, E is exchange rates against GBP, P is consumer price index, G is government expenditure, O is oil revenue, and $S^*$is foreign stock price which is usually the US stock price. * and ** significant at the 1 per cent and 5 per cent respectively. Note: The critical values are for co-integrating relations (with a constant in the co-integrating vector) estimated using the Engle-Granger methodology. Critical values are interpolated using the response surface in Engle and Granger.

5.8.2 Multivariate Cointegration Analysis: Residual-based Method

This section estimates the multivariate cointegration regression of the macroeconomic variables and GCC stock prices. Table 5.6 presents the findings of the multivariate cointegration using the seven explanatory variables in the cointegrating regressions. All cointegration regressions fail to reject the null hypothesis of no cointegration. According to these results, there is no cointegration between GCC stock prices and macroeconomic variables.

Table 5.6: Results of Testing Multivariate Cointegration Analysis: Residual-based Method

Stock prices	ADF
Kuwait	-1.31692
Saudi	-1.49058
Bahrain	-1.28651
Oman	-2.20163
Qatar	-1.38781
UAE	-2.46147

5.8.3 Bivariate Cointegration analysis: Error Correction Model

According to Granger's representation theorem, cointegration implies and is implied by the existence of a valid error correction representation model with a significantly negative coefficient on the EC term. Hence, it is possible to test for cointegration by estimating the ECM and testing its validity. The test depends on the significance of δ in Equation (5.17). The maximum lag length of the ECM is initially specified from Table 5.4, which shows VAR lags-order selection criteria for the macroeconomic variables (money supply, interest rate, consumer price, government expenditure, oil revenue and foreign stock price).

Table 5.7: Results of Testing Bivariate Cointegration: Error Correction Model

Stock prices	Macroeconomic Variables						
	M	I	E	P	G	O	S^*
	ADF	ADF	ADF	ADF	ADF	ADF	ADF
Kuwait	0.3991	-0.0497	-3.408*	-0.0513	0.3849	-0.1916	0.3986
Saudi	0.2747	-3.0269*	-1.5671	0.2709	0.2575	-3.0211*	0.2046
Bahrain	0.0455	-2.7625*	-3.832***	-2.3977	0.0431	0.8406	-1.7604
Oman	0.2691	-3.1933*	-1.2174	0.2749	-2.3854***	-0.5709	0.3921
Qatar	-3.0281*	-0.0211	-1.2792	0.1981	-3.138*	-0.0367	-0.0457
UAE	0.218193	-3.2234*	-1.5499	0.2182	0.2282	-0.0336	-0.0374

Note: M is money supply, I is interest rate, E is exchange rates against GBP, P is consumer price index, G is government expenditure, O is oil revenue, and $S^*$is foreign stock price which is usually the US stock price. *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively. Note: The critical values are for co-integrating relations (with a constant in the co-integrating vector) estimated using the Engle-Granger methodology. Critical values are interpolated.

For bivariate cointegration analysis, the estimation findings for Equation (5.17) are reported in Table 5.7. The most noticeable economic variable that predominately cointegrated with stock price is the interest rate, where four out of six stock prices are cointegrated. In addition, there is cointegration between Kuwait stock prices and exchange rate (Kuwait currency against GBP).

Further, the results show that Saudi stock prices are cointegrated with interest rate and oil revenue. It is interesting to note that Oman stock prices are cointegrated with both government expenditure and interest rate at the 10 per cent level and the 1 per cent level respectively. In addition, Qatar stock prices are cointegrated with both money supply and government expenditure. There is also cointegration between UAE stock prices and interest rate. The rest of the macroeconomic variables show no cointegration.

5.8.4 Multivariate Cointegration Analysis: Error Correction Test

After testing and interpreting the bivariate and multivariate cointegration analysis using the residual-based method, we move to multivariate cointegration analysis using the error correction test. As shown in Table 5.8, five out of the six stock market indices have significantly negative coefficients on the EC term, indicating the presence of cointegration. The only exception is Bahrain. It is interesting to note that the Bahrain stock market is dominated by foreign investors from other GCC and non-GCC countries. However, it is not clear how this characteristic can lead to a finding of no cointegration.

Table 5.8: Results of Multivariate Cointegration Analysis: Error Correction Model

Stock Markets	t-statistic
Kuwait	-2.91073*
Saudi	-3.18842*
Bahrain	-0.75887
Oman	- 3.75645*
Qatar	-2.61565*
UAE	- 2.42629

Notes: * is significant at 5 per cent. Critical values are interpolated using the response surface in Kremers et al. (1992)

5.9 Granger Causality Test—Results

Following the bivariate cointegration analysis, we test for causality between the macroeconomic variables and GCC stock prices. For this purpose, Equations (5.17) and (5.18) are estimated. Before applying the Granger causality test, we have to select the appropriate lag length for the macroeconomic variables and stock market indices by using the Bayesian Schwarz information criterion (BIC). The number of lags used for the Granger causality test is three for stock prices and five for macroeconomic variables. The optimum lag lengths for testing causality from stock prices to macroeconomic variables is three for stock price indices and four for macroeconomic variables. The findings are presented in Tables 5.9–5.14. The results vary from one country to another and from one variable to another. There are cases of bidirectional causality, unidirectional causality and no causality.

Table 5.9: Results from Granger Causality Testing—Kuwait

Macroeconomic Variables	Long-run Causality			Short-run Causality		
	Coefficient	F- Statistic	**Causality Results**	Coefficient	F- Statistic	**Causality Results**
$Ln(S)$ → ln(M)	-0.042844	-3.560301	**YES**	3.925253	1.962626	**NO**
$Ln(M)$ → ln(S)	0.000486	0.681620	**NO**	0.249745	0.124873	**NO**
$Ln(S)$ → ln(I)	-0.042064	-3.902789	**YES**	12.74886	6.374432	**YES**
$Ln(I)$ → ln(S)	-0.011898	-1.509661	**NO**	1.964019	0.982010	**NO**
$Ln(S)$ → ln(P)	-0.045133	-3.600326	**YES**	1.307882	0.653941	**NO**
$Ln(P)$ → ln(S)	0.003030	2.875158	**NO**	1.842478	0.921239	**NO**
$Ln(S)$ → ln(E)[1]	-0.047671	-3.968872	**YES**	3.028876	1.514438	**YES**
$Ln(E)$ → ln(S)[2]	0.001006	0.370518	**NO**	5.761157	2.880578	**YES**
$Ln(S)$ → ln(G)	-0.000482	-1.263180	**NO**	4.082030	2.041015	**NO**
$Ln(G)$ → ln(S)	-0.451000	-4.800435	**YES**	3.946706	1.973353	**NO**
$Ln(S)$ → ln(O)	-0.044263	-3.696465	**YES**	3.403744	1.701872	**NO**
$Ln(O)$ → ln(S)	-0.001638	-0.621391	**YES**	1.160515	0.580258	**NO**
$Ln(S)$ → ln(S^*)	-0.049952	-3.852139	**YES**	6.917048	3.458524	**YES**
$Ln(S^*)$ → ln(S)	0.001943	0.333438	**NO**	1.765885	0.882942	**NO**

Table 5.10: Results from Granger Causality Testing—KSA

Macroeconomic Variables	Long-run Causality			Short-run Causality		
	Coefficient	t- Statistic	**Causality Results**	Chi-square	F- Statistic	**Causality Results**
$Ln(S)$ → ln(M)	-0.01780	-1.68014	**YES**	1.346961	0.673481	**NO**
$Ln(M)$ → ln(S)	-0.00199	-2.267343	**YES**	3.761628	1.880814	**NO**
$Ln(S)$ → ln(I)	-0.003770	-1.402487	**NO**	1.987467	0.993733	**NO**
$Ln(I)$ → ln(S)	-0.032512	-1.851065	**YES**	5.930263	2.965131	**YES**
$Ln(S)$ → ln(P)	-0.009403	-1.122007	**NO**	1.549770	0.774885	**NO**
$Ln(P)$ → ln(S)	0.002435	3.275061	**NO**	1.061842	0.530921	**NO**
$Ln(S)$ → ln(E)[1]	-0.000145	0.078239	**NO**	6.938254	3.469127	**YES**
$Ln(E)$ → ln(S)[2]	-0.195221	-3.956955	**YES**	0.294511	0.147255	**NO**
$Ln(S)$ → ln(G)	-0.021010	-2.484623	**YES**	0.809832	0.404916	**NO**
$Ln(G)$ → ln(S)	0.005750	1.130760	**NO**	0.666718	0.333359	**NO**
$Ln(S)$ → ln(O)	-0.007582	-2.477774	**YES**	6.168791	3.084395	**YES**
$Ln(O)$ → ln(S)	-0.003699	-0.463560	**NO**	3.354645	1.677322	**NO**
$Ln(S)$ → ln(S^*)	-0.017580	-1.966547	**YES**	0.245448	0.122724	**NO**
$Ln(S^*)$ → ln(S)	-0.001128	-1.095537	**NO**	2.067906	1.033953	**NO**

Table 5.11: Results from Granger Causality Testing—Bahrain

Macroeconomic Variables	Long-run Causality			Short-run Causality		
	Coefficient	t- Statistic	**Causality Results**	Chi-square	F- Statistic	**Causality Results**
$Ln(S) \rightarrow \ln(M)$	-0.032012	-1.940120	**YES**	4.106991	2.053496	**NO**
$Ln(M) \rightarrow \ln(S)$	-0.001324	-3.645300	**NO**	5.872372	2.936186	**YES**
$Ln(S) \rightarrow \ln(I)$	-0.025445	-1.217172	**NO**	2.073833	1.036917	**NO**
$Ln(I) \rightarrow \ln(S)$	-0.030031	-2.379285	**YES**	1.597777	0.798888	**NO**
$Ln(S) \rightarrow \ln(P)$	-0.026426	-1.686852	**YES**	0.253550	0.126775	**NO**
$Ln(P) \rightarrow \ln(S)$	0.002296	0.883658	**NO**	2.531978	1.265989	**NO**
$Ln(S) \rightarrow \ln(E)^1$	-0.002418	-0.384475	**NO**	1.387980	0.693990	**NO**
$Ln(E) \rightarrow \ln(S)^2$	-0.077955	-2.298411	**YES**	0.890880	0.445440	**NO**
$Ln(S) \rightarrow \ln(G)$	-0.027508	-1.969260	**YES**	3.419322	1.709661	**NO**
$Ln(G) \rightarrow \ln(S)$	-6.69E-05	-0.533261	**NO**	0.719189	0.359594	**NO**
$Ln(S) \rightarrow \ln(O)$	-0.025481	-1.554273	**NO**	0.053343	0.026671	**NO**
$Ln(O) \rightarrow \ln(S)$	-0.000579	-1.317252	**NO**	0.139748	0.069874	**NO**
$Ln(S) \rightarrow \ln(S^*)$	-0.017268	-1.189403	**NO**	14.16106	7.080528	**YES**
$Ln(S^*) \rightarrow \ln(S)$	-0.006625	-1.506380	**NO**	0.806768	0.403384	**NO**

Table 5.12: Results from Granger Causality Testing—Oman

Macroeconomic Variables	Long-run Causality			Short-run Causality		
	Coefficient	t- Statistic	**Causality Results**	Chi-square	F- Statistic	**Causality Results**
$Ln(S) \rightarrow \ln(M)$	-0.027702	-2.083250	**YES**	0.912291	0.456146	**NO**
$Ln(M) \rightarrow \ln(S)$	-0.008540	-1.722992	**YES**	0.163323	0.081662	**NO**
$Ln(S) \rightarrow \ln(I)$	-0.006488	-1.125670	**NO**	5.613601	2.806801	**YES**
$Ln(I) \rightarrow \ln(S)$	-0.017116	-1.049354	**NO**	3.299990	1.649995	**NO**
$Ln(S) \rightarrow \ln(P)$	-0.023420	-2.050477	**YES**	3.711939	1.855970	**NO**
$Ln(P) \rightarrow \ln(S)$	-0.010823	-5.423480	**YES**	0.474248	0.237124	**NO**
$Ln(S) \rightarrow \ln(E)^1$	-0.011380	-1.749386	**YES**	10.07003	5.035016	**YES**
$Ln(E) \rightarrow \ln(S)^2$	-0.151577	-3.091090	**YES**	4.210346	2.105173	**NO**
$Ln(S) \rightarrow \ln(G)$	-0.002655	-0.380410	**NO**	3.651928	1.825964	**NO**
$Ln(G) \rightarrow \ln(S)$	-0.836365	-6.761122	**YES**	3.243698	1.621849	**NO**
$Ln(S) \rightarrow \ln(O)$	-0.010276	-0.574821	**NO**	16.50801	8.254003	**YES**
$Ln(O) \rightarrow \ln(S)$	-0.054036	-1.954548	**YES**	15.63819	7.819093	**YES**
$Ln(S) \rightarrow \ln(S^*)$	-0.011502	-1.454839	**NO**	13.97242	6.986212	**YES**
$Ln(S^*) \rightarrow \ln(S)$	-0.004762	-0.412983	**NO**	2.401845	1.200923	**NO**

Table 5.13: Results from Granger Causality Testing—Qatar

Macroeconomic Variables	Long-run Causality			Short-run Causality		
	Coefficient	t- Statistic	**Causality Results**	Chi-square	F- Statistic	**Causality Results**
$Ln(S) \rightarrow \ln(M)$	-0.018433	-2.082204	**YES**	2.002071	1.001036	**NO**
$Ln(M) \rightarrow \ln(S)$	0.003939	3.703575	**NO**	0.209698	0.104849	**NO**
$Ln(S) \rightarrow \ln(I)$	-0.018235	-2.020153	**NO**	2.116679	1.058339	**NO**
$Ln(I) \rightarrow \ln(S)$	0.009280	1.375995	**NO**	0.365390	0.182695	**NO**
$Ln(S) \rightarrow \ln(P)$	-0.019792	-2.454655	**YES**	17.83808	8.919040	**YES**
$Ln(P) \rightarrow \ln(S)$	0.002398	0.330660	**NO**	9.822288	4.911144	**YES**
$Ln(S) \rightarrow \ln(E)^1$	0.000505	0.109062	**NO**	6.430350	3.215175	**YES**
$Ln(E) \rightarrow \ln(S)^2$	-0.149548	-3.129417	**YES**	1.529031	0.764515	**NO**
$Ln(S) \rightarrow \ln(G)$	-0.043365	-1.766531	**YES**	5.609633	2.804816	**YES**
$Ln(G) \rightarrow \ln(S)$	-0.000239	-8.403045	**YES**	0.268352	0.134176	**NO**
$Ln(S) \rightarrow \ln(O)$	-0.021659	-2.004383	**YES**	13.14591	6.572953	**YES**
$Ln(O) \rightarrow \ln(S)$	-0.000281	-0.099526	**NO**	0.462953	0.231477	**NO**
$Ln(S) \rightarrow \ln(S^*)$	-0.018662	-2.086417	**YES**	25.83597	12.91799	**YES**
$Ln(S^*) \rightarrow \ln(S)$	-0.004801	-0.809165	**NO**	5.741786	2.870893	**YES**

Table 5.14: Results from Granger Causality Testing—UAE

Macroeconomic Variables	Long-run Causality			Short-run Causality		
	Coefficient	t- Statistic	**Causality Results**	Chi-square	F- Statistic	**Causality Results**
$Ln(S) \rightarrow \ln(M)$	-0.025508	-1.620428	**NO**	0.739483	0.369741	**NO**
$Ln(M) \rightarrow \ln(S)$	-0.009049	-1.619839	**NO**	0.192572	0.096286	**NO**
$Ln(S) \rightarrow \ln(I)$	-0.003943	-0.448576	**NO**	0.004539	0.002269	**NO**
$Ln(I) \rightarrow \ln(S)$	-0.034938	-2.376277	**YES**	20.48689	10.24344	**YES**
$Ln(S) \rightarrow \ln(P)$	0.001089	0.296431	**NO**	0.951705	0.475853	**NO**
$Ln(P) \rightarrow \ln(S)$	-0.066013	-2.523597	**YES**	8.998739	4.499370	**YES**
$Ln(S) \rightarrow \ln(E)^1$	-0.016557	-1.786463	**YES**	3.557281	1.778640	**NO**
$Ln(E) \rightarrow \ln(S)^2$	-0.239277	-3.636282	**YES**	5.520405	2.760203	**YES**
$Ln(S) \rightarrow \ln(G)$	-0.027862	-1.934230	**YES**	2.641863	1.320932	**NO**
$Ln(G) \rightarrow \ln(S)$	-0.000527	-3.193985	**YES**	0.002837	0.001419	**NO**
$Ln(S) \rightarrow \ln(O)$	-0.022074	-1.300202	**NO**	3.075413	1.537706	**NO**
$Ln(O) \rightarrow \ln(S)$	-0.012181	-0.997857	**NO**	1.201157	0.600578	**NO**
$Ln(S) \rightarrow \ln(S^*)$	-0.020430	-1.727257	**YES**	6.473067	3.236534	**YES**
$Ln(S^*) \rightarrow \ln(S)$	-0.008927	-0.668626	**NO**	4.203242	2.101621	**NO**

5.10 Forecasting Results

The random walk model and the fundamental stock price model are estimated and subsequently used to generate forecasts. Table 5.25 displays the estimated random walk model with drift. The drift factor is significant in some cases and insignificant in others. The coefficient on the lagged dependent variable in the autoregressive process is significantly positive in all cases. As these coefficients are insignificantly different from

1, it is expected that the random walk model with drift will generate forecasts that are similar to those generated by the random walk model without drift. Table 5.16 presents the measures of forecasting accuracy, and Figure 5.87 shows the forecasts generated by the random walk model.

Table 5.15: Estimated Random Walk Model

Stock Markets	α	P-value	sp_{t-1}	P-value	R^2
Kuwait	379.1236	0.0188	0.956863	0.0000*	0.940464
Saudi	179.8311	0.0780	0.977050	0.0000*	0.964020
Bahrain	34.90588	0.2519	0.977251	0.0000*	0.952280
Oman	7.840684	0.1870	0.988927	0.0000*	0.979500
Qatar	184.9024	0.0751	0.979363	0.0000*	0.964687
Arab Emirates	85.63228	0.0780	0.974536	0.0000*	0.955814

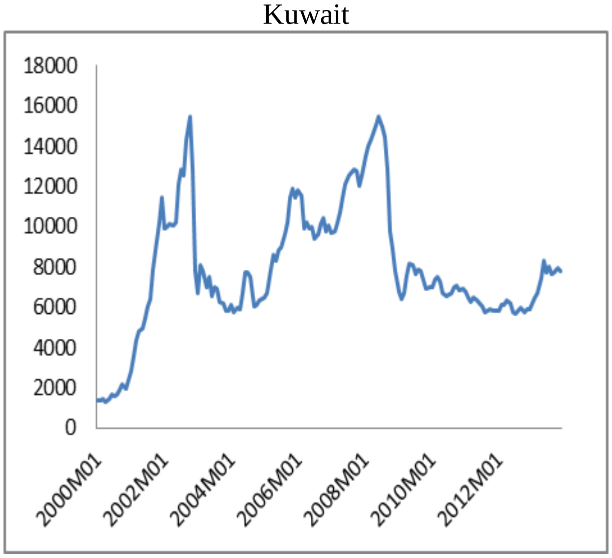
Note: * is significant at the 99 per cent confidence level.

Table 5.16: Measures of Predictive Accuracy of the Random Walk Model

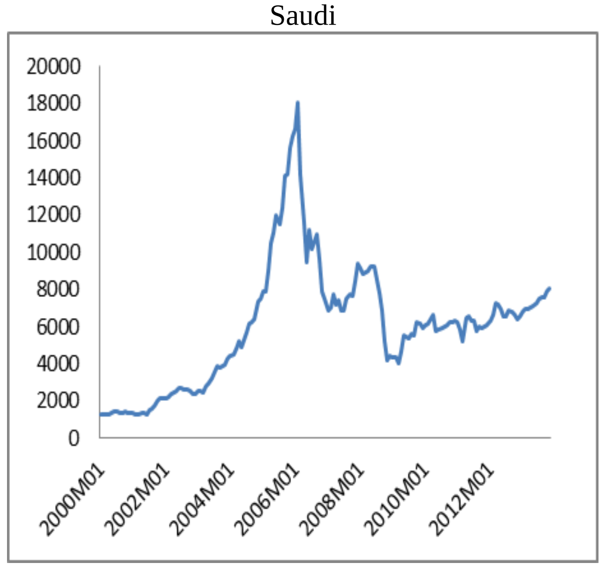
Stock Markets	MAE	MSE	RMSE
Kuwait	0.06327	0.00811	0.09008
Saudi	0.05861	0.00631	0.07944
Bahrain	0.04844	0.00596	0.07721
Oman	0.04080	0.00302	0.05498
Qatar	0.06632	0.00786	0.08866
Arab Emirates	0.05038	0.00520	0.07208

Figure 5.87: Forecasts Generated by the Random Walk Model

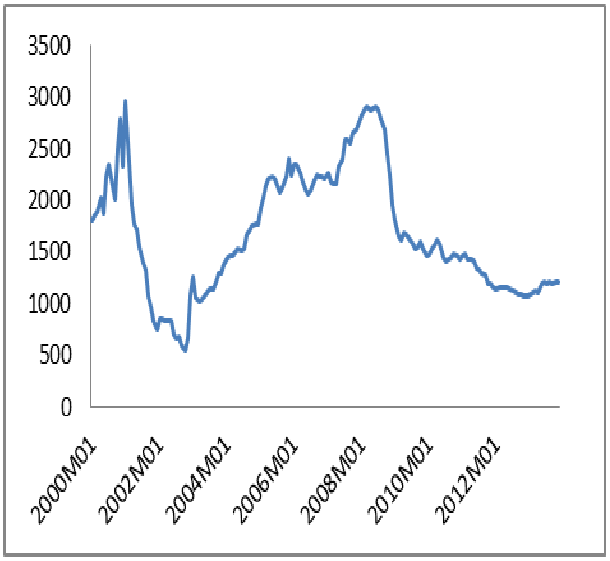
Kuwait



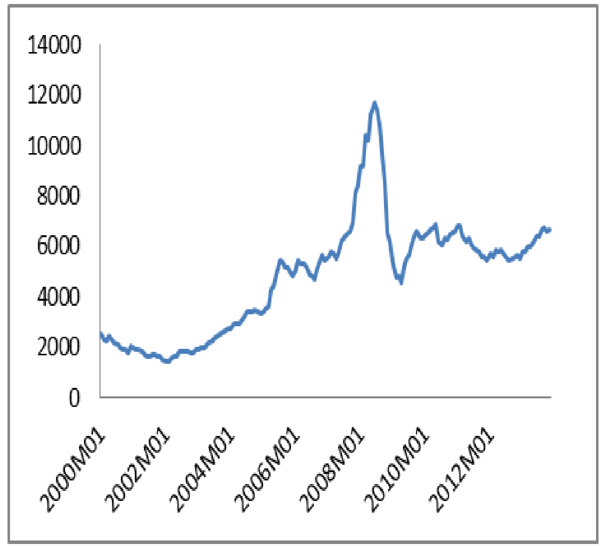
Saudi



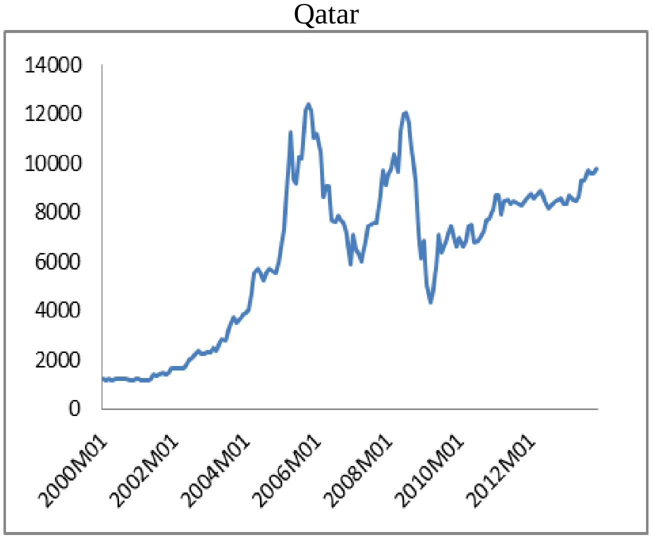
Bahrain



Oman



Qatar



UAE

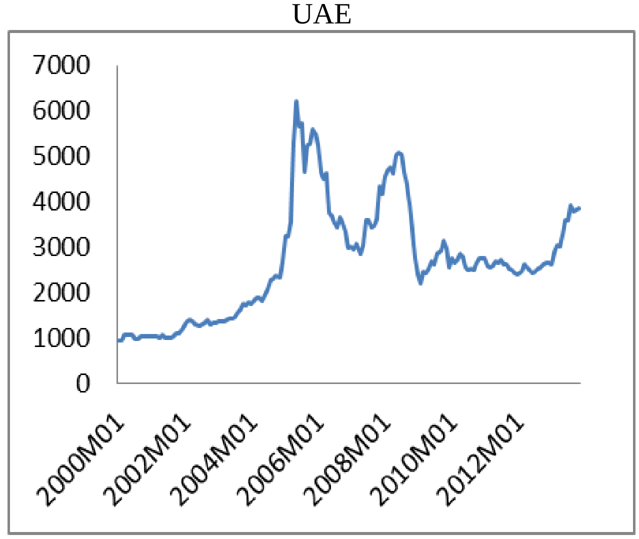


Table 5.17 reports the results of the stock price determination model using macroeconomic factors as explanatory variables. Again, the results differ from one country to another. As the objective here is forecasting rather than hypothesis testing, we should not be overly concerned about the *t*-statistics or the signs of the estimated coefficients. Rather, we should be concerned about measures of forecasting accuracy (see Table 5.18). As expected, *U* is greater than 1 in all cases, implying that the random walk model outperforms the stock price forecasting model in terms of the magnitude of the

error. The results of the AGS test reported in Table 5.19 confirm that the RMSE of the random walk model is significantly smaller than the RMSE of the stock price forecasting model. However, the stock price forecasting model is better than the random walk model in predicting the direction of change as judged by measures of DA.

Table 5.17: Estimated Regression of the Stock Price Forecasting Model

	b_0	b_1	b_2	b_3	b_4	b_5	b_6	b_7	R^2
Kuwait	38.959*** [3.79]	1.633*** [6.75]	-373.4** [-2.59]	-960.3** [-8.26]	12.43*** [2.83]	-0.0653*** [-0.29]	5.496** [8.017]	-0.58 [-3.59]	0.455
Saudi	-70.19 [-0.39]	19.95 [6.44]	529.48** [3.97]	-390.3** [-4.94]	26.69** [0.55]	0.046*** [5.29]	9.23*** [8.92]	-0.60 [-4.60]	0.737
Bahrain	-66.86 [-0.68]	0.89 [8.20]	229.92* [12.46]	-17.79 [-1.86]	19.86 [0.77]	-2.40 [-9.59]	-7.04 [-0.48]	0.21 [8.93]	0.778
Oman	27.04*** [3.87]	0.045*** [5.45]	20.31*** [3.83]	-0.24*** [-6.20]	-65.4* [-3.56]	-0.078 [-0.88]	0.32*** [16.17]	-0.03** [-5.19]	0.851
Qatar	-79.63*** [-6.15]	-31.2 [-9.98]	291.62** [2.33]	15.70 [1.42]	22.04* [6.15]	-0.34 [-4.61]	0.047*** [7.26]	-0.031 [-0.03]	0.825
Arab Emiratis	30.34*** [4.77]	-0.92 [-0.50]	173.91*** [2.78]	-2.72 [-2.03]	-82.6* [-4.77]	-0.07 [-0.41]	0.0017*** [4.96]	-0.04 [-0.57]	0.491

Note: *, ** and *** indicate statistical significance at 1, 5 and 10 per cent respectively. t-statistics are in parentheses.

Table 5.18: Measures of Predictive Accuracy from the Stock Price Forecasting Model

Stock Markets	MAE	MSE	RMSE	U	DA	CR
Kuwait	0.28105	0.15854	0.398168382	1.118711502	0.55090	0.44910
Saudi	0.23717	0.09681	0.311141978	1.083894267	0.46707	0.53293
Bahrain	0.14999	0.04208	0.20514477	1.069737247	0.47305	0.52695
Oman	0.15866	0.03965	0.199119675	1.036547467	0.50299	0.49701
Qatar	0.16726	0.04968	0.222900169	1.028797553	0.62874	0.37126
Arab Emirates	0.24799	0.09929	0.315105132	1.077405331	0.56287	0.43713

Table 5.19: AGS Test Results

	γ_0	γ_1	Wald ($\gamma_0 = \gamma_1 = 0$)
Kuwait	0.142944*	0.844781*	1680.603
	(10.85)	(39.53)	
Saudi	0.050671*	0.793275*	627.7104
	(4.47)	(24.65)	
Bahrain	0.031611*	0.681031*	393.7026
	(3.32]	(19.56)	
Oman	0.009292*	0.786659*	484.0613
	(1.18)	(21.97)	
Qatar	0.066005*	0.576876*	260.8346
	(6.21)	(14.91)	
UAE	0.097304*	0.854070*	959.8499
	(9.53)	(29.48)	

Notes: The chi-square distribution has a critical-value of 5.99 at the 5 per cent level of statistical significance. t-statistics are in parentheses. An asterisk means rejection of H_0.

Figure 5.88 presents the predicted and actual values of stock prices. As shown, the random walk model produces smaller forecasting errors than the stock price forecasting model, but this does not mean that the random walk model is a good forecaster. The forecast values follow the actual values, which cannot be a characteristic of a good forecasting model. Further, the fundamental model performs better in terms of DA. The prediction-realisation diagrams in Figure 5.89 confirm that the model has a reasonable level of forecasting accuracy. However, deviations from the line of perfect forecasts are significant, implying large forecasting errors in terms of magnitude.

Figure 5.88: Forecasting Stock Price Horizon

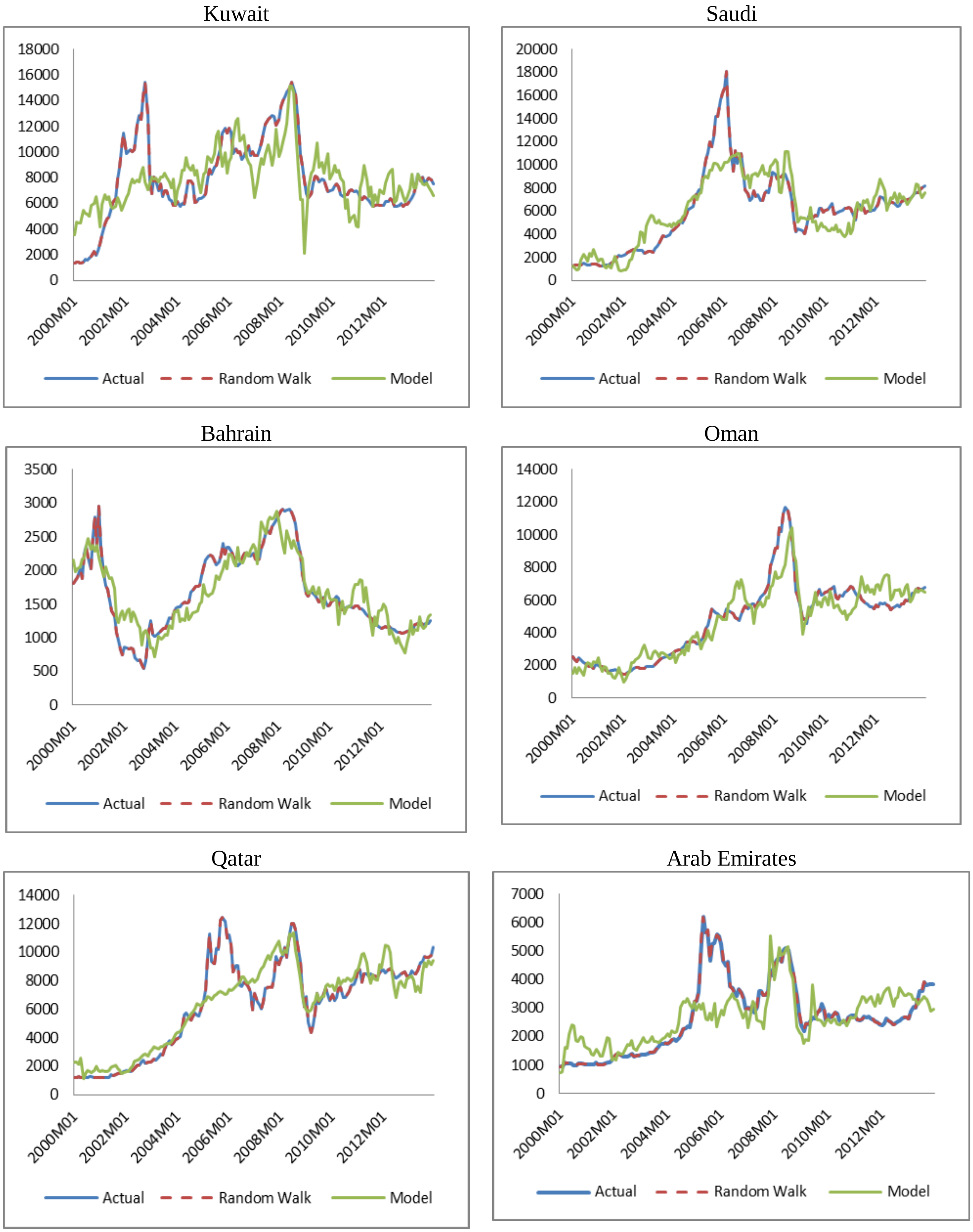
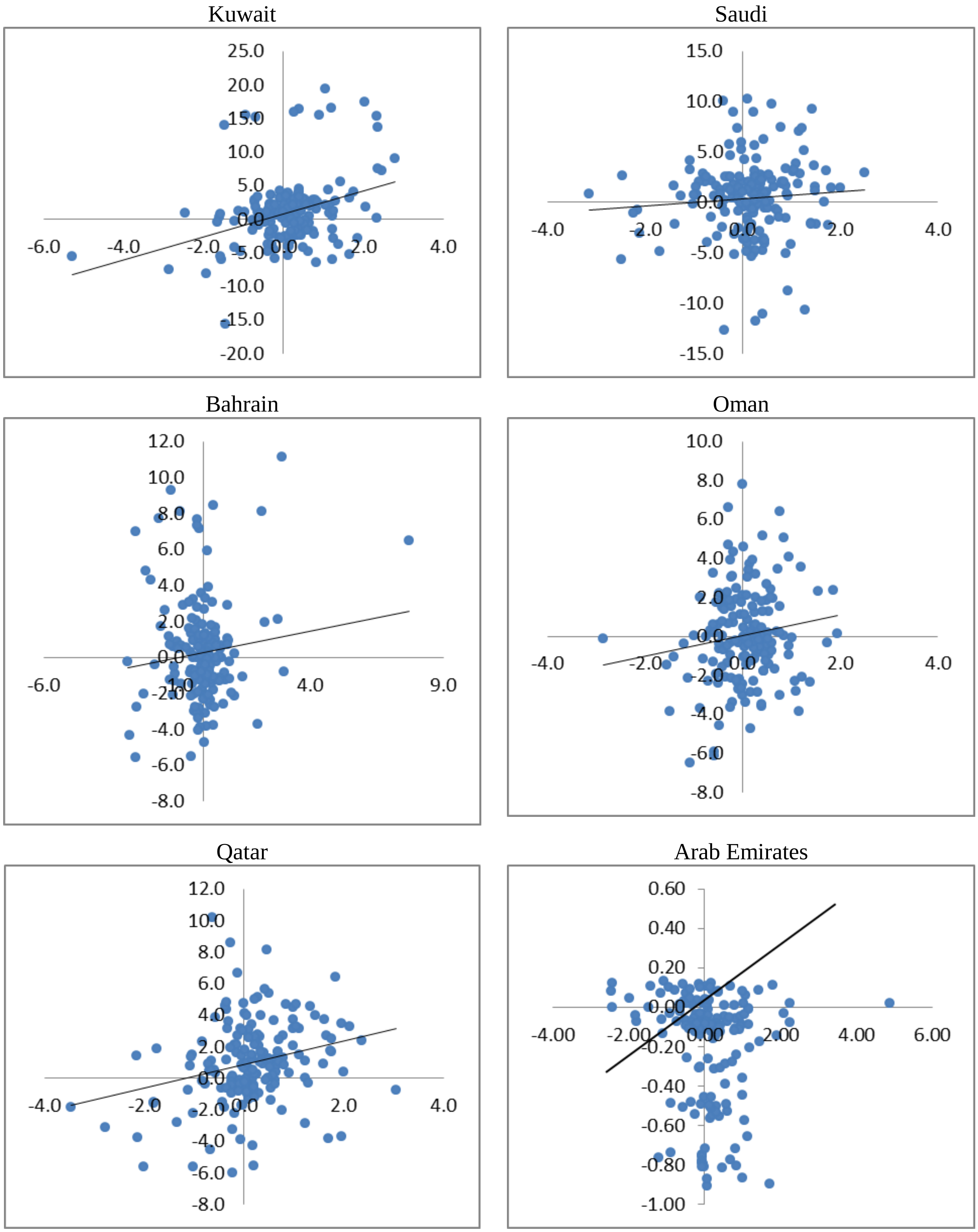


Figure 5.89: Prediction-realisation Diagrams—Forecasting Horizon



5.11 Conclusion

This chapter examined the relationships between macroeconomic variables (money supply, interest rate, consumer price index, exchange rate, government expenditure, oil revenue and foreign stock price) and stock market indices in the GCC economies. By applying cointegration tests, error correction modelling and causality testing on a monthly data set, some evidence was found of a long-run relation between stock prices and macroeconomic variables. However, the results are country- and variable-specific.

The forecasting results confirm the universality of the Meese–Rogoff results. They firmly establish that the random walk model is unbeatable in terms of the magnitude of the forecasting error, but this does not mean that the random walk model produces superior forecasts. The same result that holds for exchange rates also holds for stock prices. However, the Meese–Rogoff puzzle holds only when forecasting accuracy is assessed by the magnitude of the forecasting error alone. Otherwise, as in the case of exchange rates, it is not a puzzle at all.

Chapter 6: Profitability of Domestic and Foreign Stock Trading

6.1 Introduction

One of the major controversies between applied finance and academics is the advantages and benefits of trading strategies. Trading rules are intended to find patterns in prices to give some indication as to future stock price movements. Since the research of Fama and Blume (1966), most researchers have accepted that the worth of these *ad hoc* predicting methods is probably close to zero. Nonetheless, evidence in foreign stock markets has been much more supportive of the usefulness of trading rules. Some of these trading rules depend on so-called 'foreign exchange puzzles', such as deviations from uncovered interest parity and the forward bias.

In this chapter, the simple trading rules are analysed and then applied to historical sample data series on GCC stock prices and exchange rates. This is by no means the only available trading rules, but it is the most common. Basic trading rules are mechanical in nature. The transactions are conducted according to the buy-and-sell signals generated by the underlying trading rule, starting with a buy signal and ending with a sell signal. When a buy signal is generated, the underlying asset and the position is kept until a sell signal is generated. At this time, the asset is sold and a position in the domestic currency is restored. Nothing is done until a buy signal arises again, and then the process is repeated. Naturally, a transaction is profitable if the selling price is higher than the buying price, and vice versa. At the end of trading (the last sell transaction) the net profit generated from trading throughout the sample period is calculated.

6.2 Literature Review

Many studies have been conducted to determine whether trading rules are profitable. The main objective of these studies is to investigate the efficiency of financial markets. If financial markets are efficient, a passive buy-and-hold strategy could not consistently produce profits over and above what is achieved by a simple buy-and-hold strategy. This section discusses the empirical evidence for different strategies to measure the profitability of trading rules, such as technical trading, and it discusses the profitability of stock trading in the domestic and foreign markets.

Allen and Karjalainen (1999) criticised the literature on the grounds that the *ex post*, *ad hoc* specification of stock trading rules may lead to biased test findings. They argued that genetic algorithms can be used to derive different trading rules that are not *ad hoc*, but that are optimal. They contended that this approach makes it possible to avert the potential bias caused through the *ex post* view that 'this has happened because the trading rules are selected through a machine learning algorithms using price data available prior the beginning of the test period' (Allen and Karjalainen 1999). Nonetheless, their findings confirmed those of prior research, indicating that stock markets are efficient in the sense that there are no opportunities to generate profits net of transaction costs using different trading rules. This literature review deals with two issues: (i) the profitability of stock trading in foreign and domestic markets, and (ii) trading rules in the stock market.

6.2.1 Profitability of Stock Trading in Foreign and Domestic Markets

According to Hau (2001) and Dvorak et al. (2000), local stock market traders have an information advantage over foreign investors because they analyse model inventory on transaction-level trading stock performance. Ha's results revealed an information asymmetry between Euro countries in that domestic stock investors in Germany generate higher returns in their local stock market than traders from other countries. Likewise, Choe, Kho, and Stulz (2001) analysed the performance of foreign and domestic stock market investors using the volume-weighted average price and found that local traders have an information advantage over foreign traders in the same stock market. Grinblatt and Keloharju (2000) put forward a different opinion, demonstrating that foreign financial institutions outperform local institutions because they have better access to expertise and resources. By analysing daily/monthly international portfolios flows, Froot and Ramadorai (2005) argued that foreign institutions are more capable of forecasting stock market returns than local traders. However, this view is not universally accepted. For example, Kang and Stulz (1997) and Kho, Stulz and Choe (2001) failed to find any evidence for the proposition that foreign traders outperform local traders. They analysed the differences among value-weighted returns on market portfolios in Japan and foreign international portfolios and suggested that local traders in Japan perform the same as foreign traders.

6.2.2 Trading Rules in the Stock Market

There has been mixed empirical evidence regarding the initial application of filter rules to the stock markets. Alexander (1964) provided empirical evidence for the capability of the mechanical trading rules to beat the stock market, despite transaction costs. In contrast, Fama and Blume (1966) found that filter rules cannot produce any profits. Following Fama and Blume (1966) study, the mainstream academic opinion was that mechanical trading rules do not work. Fama (1970) rejected technical analysis and described mechanical trading rules as ‘useless’. Brock, Lakonishok, and Lebaron (1992) investigated the performance of different simple moving-average rules by ignoring transaction costs. They concluded that trading rules help identify the intervals in which it is wise to invest in the markets—that is, when the rate of return is high and variability is low.

By analysing a sample series from the Sydney Futures Exchange, Raj (1988) found that investment returns cannot be realised using basic trading rules. Hudson, Dempsey, and Keasey (1995) found that long-run buy-and-hold strategies eliminate the possibility of boosting investment returns when taken in aggregation with the ‘round-trip’ costs of the transaction. Mills (1998) used more sophisticated econometric analysis, but he was unsuccessful in obtaining results that differed from those of Hudson, Dempsey, and Keasey (1995).

Qi and Wu (2001) used intraday data for the US stock market to confirm the proposition that trading rules cannot beat a buy-and-hold strategy because of the trading costs and the time needed to perform the actual trading. Ojah and Karemera (1999) investigated four emerging stock markets in Latin America and concluded that they follow the naïve random walk model, usually described as weak-form efficient. Further, Coutts and

Goodhart (1991) applied trading rules to the Hang Seng Index and found that technical analysis does not provide a return net of transaction costs or the associated opportunity costs of investing. Based on technical analysis, the information included in previous stock prices is not correctly incorporated in current stock prices (Wang 1998). Further, technical analysis ceases to be profitable even under the assumption of zero transaction costs (Goodacre and Kohn-Speyer 2001). However, Isakov and Hollstein (1998) gave qualified support to technical analysis, finding that transaction costs remove technical trading profits in the Swiss stock market.

6.3 Model

6.3.1 Trading Strategy

This research is based on a simple trading strategy whereby a long position is taken (the stock is bought) when the forecast return is positive. When the forecast return does not change, the position is maintained. The expected return on domestic stock investment at time *t* for time *t*+1 is:

$$\pi^e = 100\left[\frac{\hat{S}_{t+1}}{S_t} - 1\right] \tag{6.1}$$

If $\pi^e > 0$ capital is converted into stocks and the position is kept until $\pi^e < 0$, when the stocks are sold and converted back into cash. The cash is kept to earn interest until another buy signal is generated. This operation is repeated over the whole sample period, starting with a buy signal and ending with a sell signal. The rate of return on each buy–sell transaction is as follows:

$$\pi_t^{t+k} = 100 \times \left[\frac{S_{t+k}}{S_t} - 1 \right] \times \frac{12}{k} \tag{6.2}$$

where buying takes place at t and selling takes place at $t+k$. The mean and standard deviation of π_t^{t+k} can be easily calculated.

In the case of foreign stock trading, we take into account changes in the exchange rate (measured as domestic/foreign). The expected return is given by:

$$\pi^e = 100 \times \left[\left(\frac{\hat{S}_{t+1}}{S_t} - 1 \right) + \left(\frac{\hat{E}_{t+1}}{E_t} - 1 \right) \right] \tag{6.3}$$

The return on each buy–sell transaction is given by:

$$\pi_t^{t+1} = 100 \times \left[\left(\frac{S_{t+k}}{S_t} - 1 \right) + \left(\frac{E_{t+k}}{E_t} - 1 \right) \right] \times \frac{12}{k} \tag{6.4}$$

The average annual compound rate of return is:

$$\mathrm{AACR} = 1200 * \left[\left(\frac{K_n}{K_0} \right)^{1/(n-1)} - 1 \right] \tag{6.5}$$

where K_0 is the initial capital and K_n is the final capital.

The mean rate of return for domestic stock investment and foreign stock investment is:

$$\overline{\pi}^d = \frac{1}{m} \sum_{j=1}^{m} \pi_j^d \text{ and } \overline{\pi}^f = \frac{1}{h} \sum_{j=1}^{h} \pi_j^d \tag{6.6}$$

The cumulative return is:

$$\mathrm{CR} = \left[\prod_{t=1}^{n} (1 + \pi_t) \right] - 1] \tag{6.7}$$

The variances of domestic and foreign returns are given by:

$$\sigma^2\left(\pi^d\right) = \frac{1}{m-1}\sum_{j=1}^{m}\left(\pi_j^d - \overline{\pi}^d\right)^2 \tag{6.8}$$

and:

$$\sigma^2\left(\pi^f\right) = \frac{1}{h-1}\sum_{j=1}^{h}\left(\pi_j^f - \overline{\pi}^f\right)^2 \tag{6.9}$$

The corresponding standard deviations are:

$$\sigma\left(\pi^d\right) = \sqrt{\frac{1}{m-1}\sum_{j=1}^{m}\left(\pi_j^d - \overline{\pi}^d\right)^2} \tag{6.10}$$

and:

$$\sigma\left(\pi^f\right) = \sqrt{\frac{1}{h-1}\sum_{j=1}^{h}\left(\pi_j^f - \overline{\pi}^f\right)^2} \tag{6.11}$$

In evaluating alternative investments, both risk and return must be taken into account. The Sharpe ratio is the return per unit of risk, which is calculated as follows:

$$\mathrm{SR} = \frac{\overline{\pi}_t}{\mathrm{SD}(\pi_t)} \tag{6.12}$$

This means that the Sharpe ratio is a measure of risk-adjusted return.

6.3.2 Hypothesis Testing

Consider two time series on the domestic transaction rate of return ($\pi_1^d, \pi_2^d, \ldots \pi_m^d$) and a time series on the foreign transaction rate of return ($\pi_1^f, \pi_2^f, \ldots \pi_h^f$). This means that *m* is the buy–sell transactions in the domestic market and *h* is the transactions in the foreign market. The means of the domestic and foreign rates of return are:

$$\bar{\pi}^{d} = \frac{1}{m}\sum_{j=1}^{m}\pi_{j}^{d} \tag{6.13}$$

$$\bar{\pi}^{f} = \frac{1}{h}\sum_{j=1}^{h}\pi_{j}^{f} \tag{6.14}$$

The variances are calculated as:

$$\sigma^{2}(\pi^{d}) = \frac{1}{m-1}\sum_{j=1}^{m}\left(\pi_{j}^{d} - \bar{\pi}^{d}\right)^{2} \tag{6.15}$$

$$\sigma^{2}(\pi^{f}) = \frac{1}{h-1}\sum_{j=1}^{h}\left(\pi_{j}^{f} - \bar{\pi}^{f}\right)^{2} \tag{6.16}$$

Accordingly, tests of equality of means and variances are conducted.

6.4 Empirical Results

This section reports the results of applying the trading rule described in the previous section for the 18 price series under investigation. This rule is applied to eight financial price series, including nine exchange rates at three frequencies and nine stock prices at nine frequencies. As is customary, the hypothetical trader starts with a principal of local currency (100 units), buys the underlying stock when there is a buy signal and holds it until a sell signal emerges. Table 6.1 reports the average annual compound rate return (AACR) obtained from various investment strategies. The highest return is obtained by Kuwaiti-based investors investing in the UK stock market.

Table 6.1: Average Annual Compound Rate (%)

	UK (Monthly)	US (Monthly)	JAP (Monthly)	Market Index (Monthly)
KWD	2.5714	1.6730	0.7809	2.34707
SAR	1.6096	0.9477	(-1.5722)	2.33489
BHD	0.3668	(-2.1998)	0.4713	0.15763
OMR	0.4554	0.8815	0.6036	1.23530
QAR	1.7413	1.1914	0.5543	2.78917
AED	1.3141	1.6385	2.1478	1.83228

However, Table 6.1 does not show the level of risk embodied in these investments. Therefore, Table 6.2 provides information about the level of risk, measured in terms of variance and standard deviation. As shown, the standard deviation of the return on domestic stock markets is relatively higher than those for foreign stock markets, except the Japan stock market. The Sharpe ratio also leads to the same conclusion. Table 6.3 reports the results of hypothesis testing and shows no significant differences in any case. This is because the returns are not normally distributed, but it is estimated with large standard errors, leading to insignificant *t*-statistics. Figures 6.1–6.6 present the profitability graphs, starting with an initial capital of 100 units of the domestic currency. In most cases, the trading produces profits.

Table 6.2: Measures of Profitability of GCC Stock Price and Foreign Stock Price

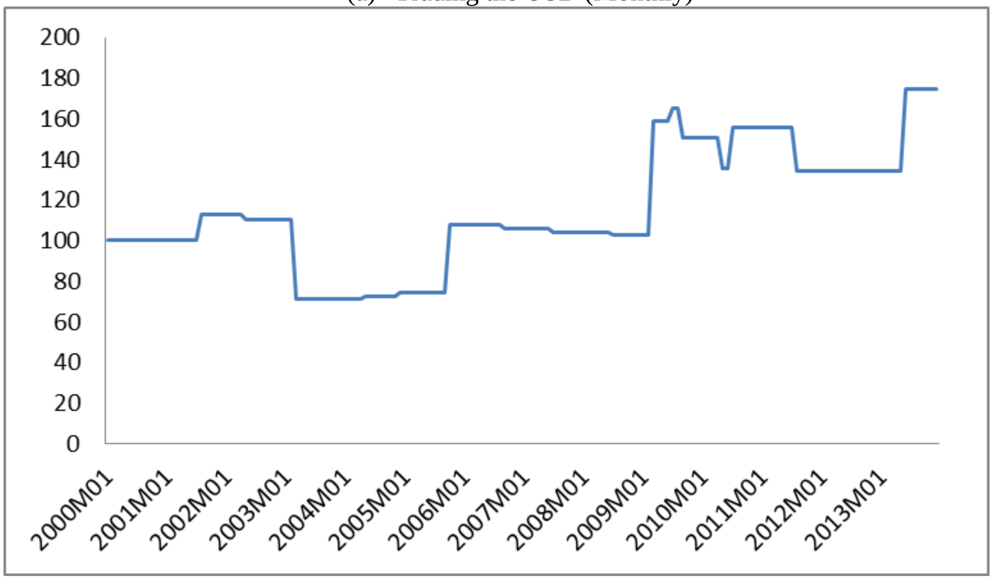
	Domestic and Foreign Stock Price		Domestic and Foreign Stock Price		Domestic and Foreign Stock Price	
	Domestic	USA	Domestic	UK	Domestic	JAP
Kuwait						
Mean Rate of Return	7.4431	3.7035	6.4033	4.0220	3.3322	2.4134
Total Rate of Return	89.3171	66.6626	64.0334	96.5274	43.3184	19.3070
Std Dev	23.4648	16.05901	35.2098	24.255	21.6585	45.2178
Variance	550.5977	257.9066	1239.7291	588.3050	469.0887	2044.6523
Sharpe(SD)	0.3172	0.3071	0.1819	0.2560	0.1539	0.0534
KSA						
Mean Rate of Return	1.5500	3.7035	1.3518	4.0220	3.4349	2.4134
Total Rate of Return	20.1497	66.6626	18.9254	96.5274	41.2190	19.3070
Std Dev	24.2652	16.05901	55.2007	24.255	23.4820	45.2178
Variance	576.1081	257.9066	3047.1173	588.3050	653.0286	2044.6523
Sharpe(SD)	0.0245	0.3071	0.0245	0.2560	0.1344	0.0534
Bahrain						
Mean Rate of Return	9.0576	3.7035	0.3726	4.0220	3.6395	2.4134
Total Rate of Return	126.8063	66.6626	4.8435	96.5274	61.8714	19.3070
Std Dev	14.5199	16.05901	35.333	24.255	22.4984	45.2178
Variance	237.1343	257.9066	1248.3944	588.3050	506.1788	2044.6523
Sharpe(SD)	0.5882	0.3071	0.0243	0.2560	0.1618	0.0534
Oman						
Mean Rate of Return	4.3448	3.7035	4.5514	4.0220	3.1860	2.4134
Total Rate of Return	78.2066	66.6626	31.8601	96.5274	31.8601	19.3070
Std Dev	27.1304	16.05901	32.498	24.255	25.3225	45.2178
Variance	736.0573	257.9066	1056.1471	588.3050	641.2287	2044.6523
Sharpe(SD)	0.1601	0.3071	0.0842	0.2560	0.1258	0.0534
Qatar						
Mean Rate of Return	5.6778	3.7035	5.5230	4.0220	-9.4065	2.4134
Total Rate of Return	73.8120	66.6626	88.3675	96.5274	-150.5047	19.3070
Std Dev	26.262	16.05901	15.6247	24.255	49.4528	45.2178
Variance	689.6884	257.9066	244.1324	588.3050	2445.5809	2044.6523
Sharpe(SD)	0.1940	0.3071	0.5141	0.2560	-0.1902	0.0534
UAE						
Mean Rate of Return	5.6776	3.7035	8.1497	4.0220	11.3192	2.4134
Total Rate of Return	79.4870	66.6626	122.2453	96.5274	215.0640	19.3070
Std Dev	53.6838	16.05901	28.4317	24.255	24.0477	45.2178
Variance	2881.9457	257.9066	808.3620	588.3050	578.2922	2044.6523
Sharpe(SD)	0.1058	0.3071	0.2866	0.2560	0.4707	0.0534

Table 6.3: Hypothesis Testing Results

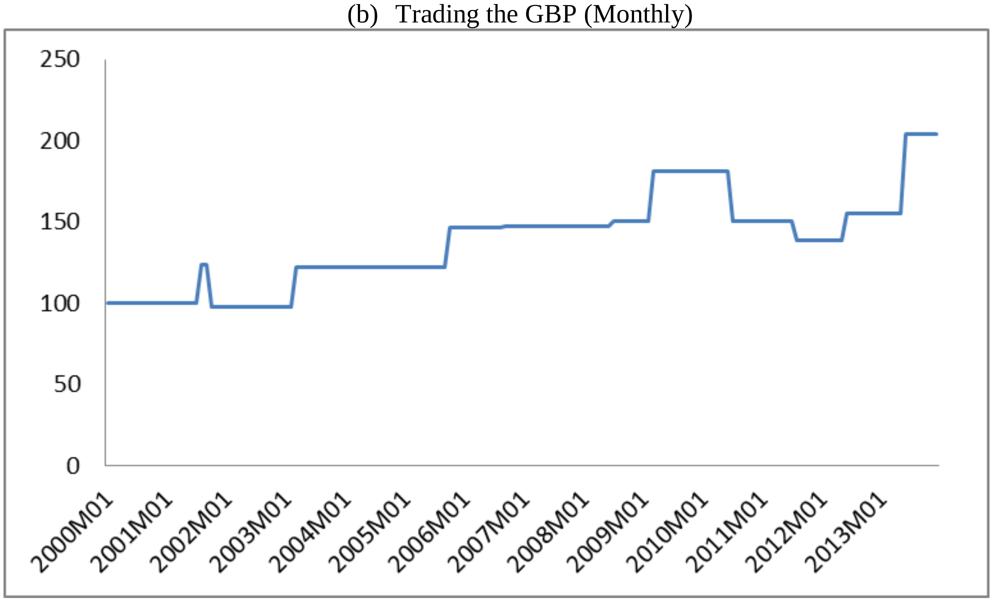
Domestic Stock Market	Foreign Stock Market	Equality of Mean Returns	Equality of Variance
Kuwait	USA	Not significant 0.093< 2.0484	Not significant 2.13 < 2.413
	UK	Not significant 0.0224< 2.0369	Not significant 2.107< 2.320
	Japan	Not significant 0.0011< 2.0860	Not significant 2.212< 3.550
KSA	USA	Not significant 0.202< 2.0555	Not significant 2.088< 2.534
	UK	Not significant 0.603< 2.0518	Not significant 0.915< 2.507
	Japan	Not significant 0.106< 2.1009	Not significant 0.270< 3.603
Bahrain	USA	Not significant 0.602< 2.0423	Not significant 0.818< 2.353
	UK	Not significant 1.823< 2.0301	Not significant 2.122< 2.204
	Japan	Not significant 0.122< 2.0930	Not significant 0.248< 3.575
Oman	USA	Not significant 0.046< 2.0484	Not significant 1.963< 2.685
	UK	Not significant 0.015< 2.0452	Not significant 1.795< 2.528
	Japan	Not significant 0.088< 2.1199	Not significant 0.314< 3.677
Qatar	USA	Not significant 0.105< 2.0687	Not significant 2.674< 2.788
	UK	Not significant 0.227< 2.0244	Not significant 0.415< 2.128
	Japan	Not significant 0.056< 2.0084	Not significant 1.196< 2.4595
UAE	USA	Not significant 0.024< 2.0639	Not significant 0.089< 2.761
	UK	Not significant 0.077< 2.0513	Not significant 0.702< 2.128
	Japan	Not significant 0.147< 2.0595	Not significant 0.283< 3.467

Figure 6.1: Profit/Loss Diagrams (Basic Trading Rule)—Kuwait

(a) Trading the USD (Monthly)



(b) Trading the GBP (Monthly)



(c) Trading the JPY (Monthly)

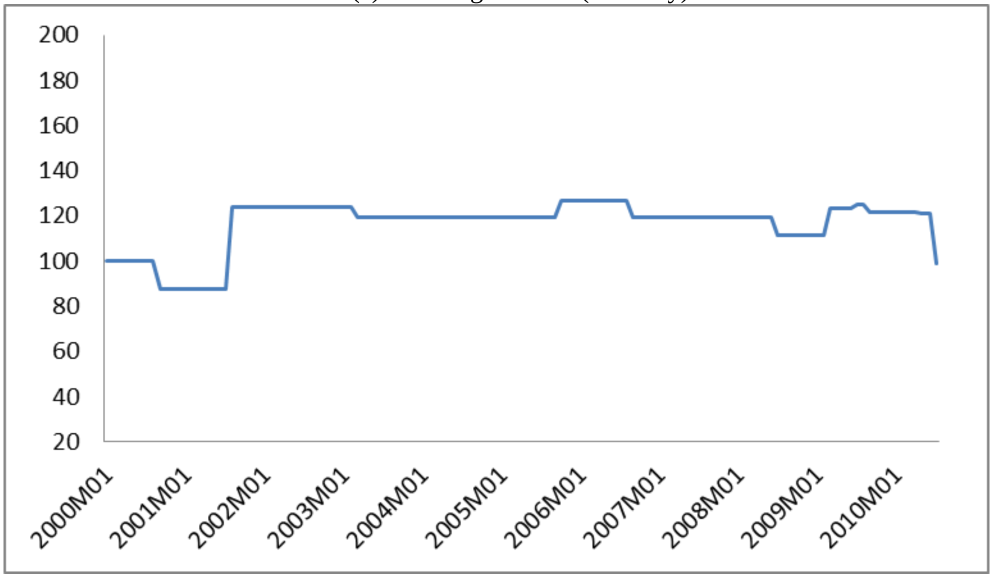
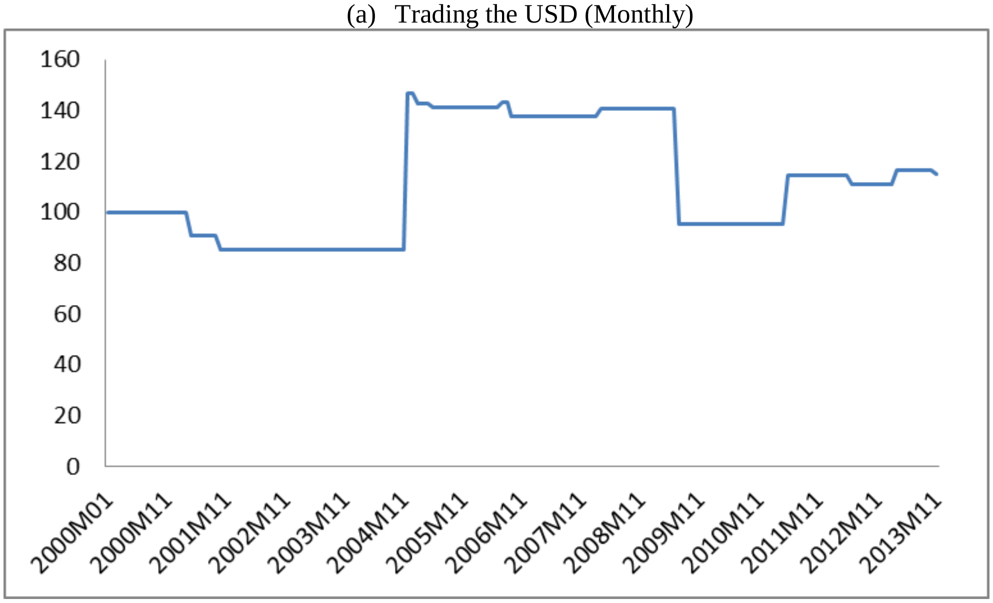
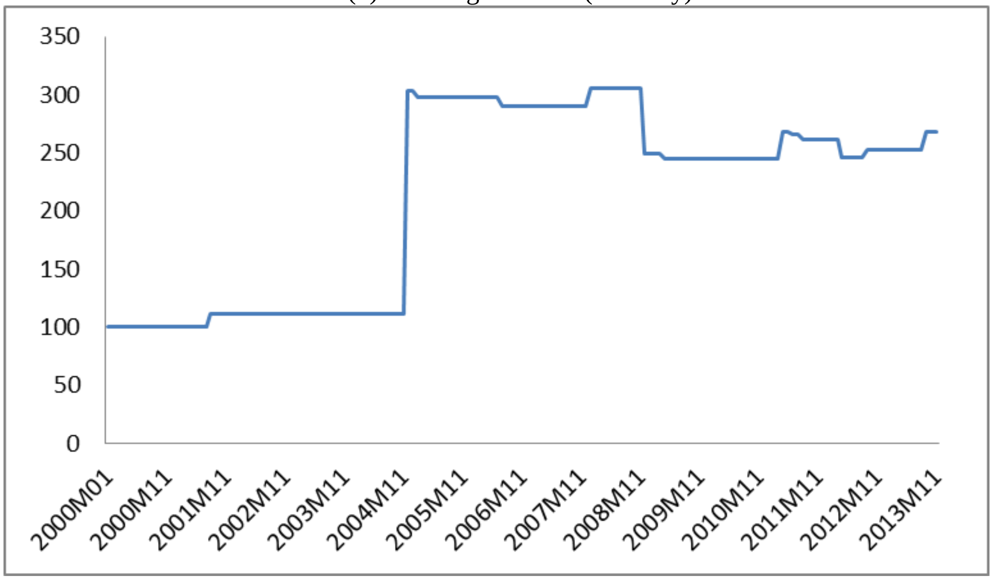


Figure 6.2: Profit/Loss Diagrams (Basic Trading Rule)—KSA

(a) Trading the USD (Monthly)



(b) Trading the GBP (Monthly)



(c) Trading the JPY (Monthly)

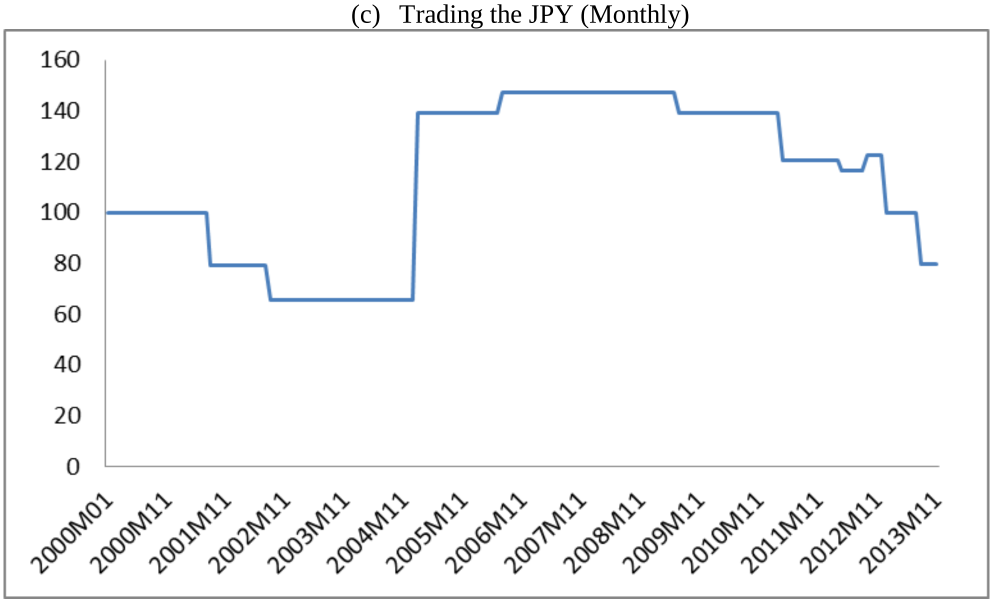
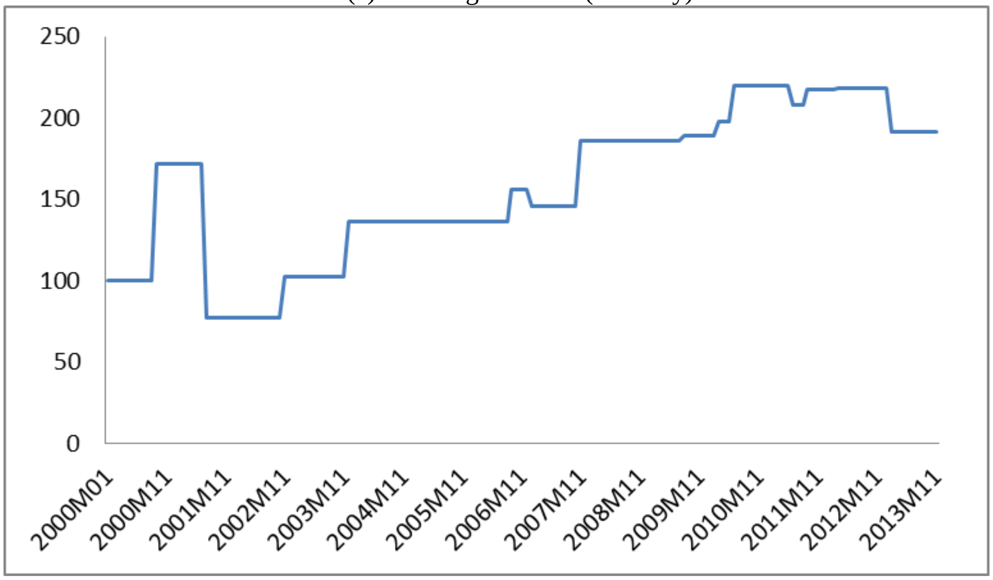
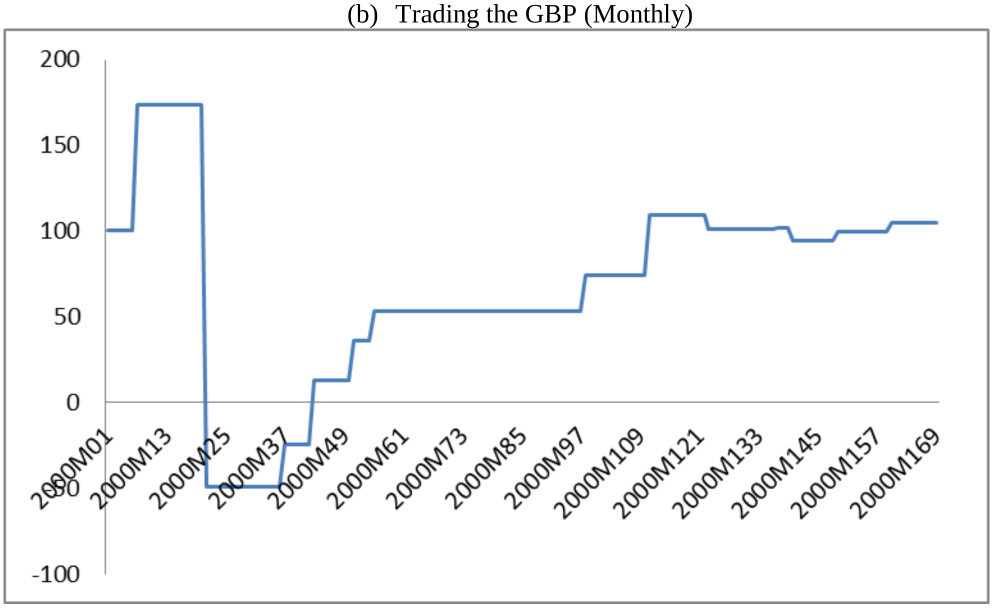


Figure 6.3: Profit/Loss Diagrams (Basic Trading Rule)—Bahrain

(a) Trading the USD (Monthly)



(b) Trading the GBP (Monthly)



(c) Trading the JPY (Monthly)

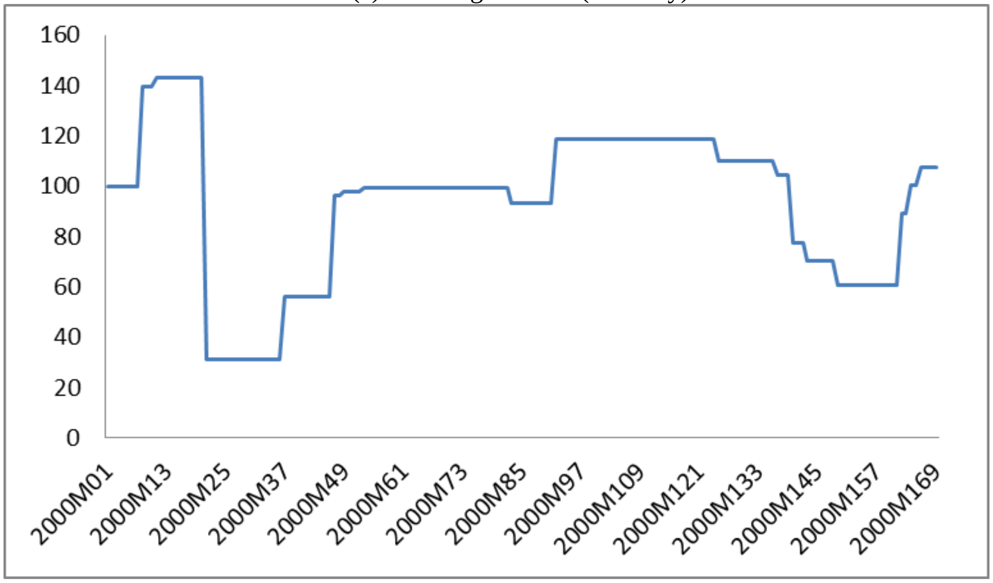
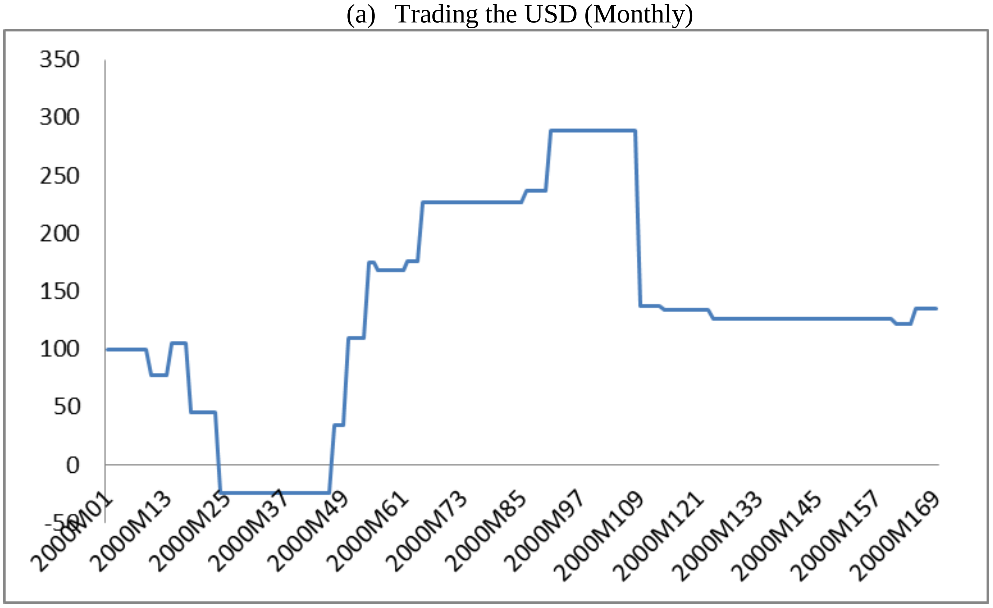
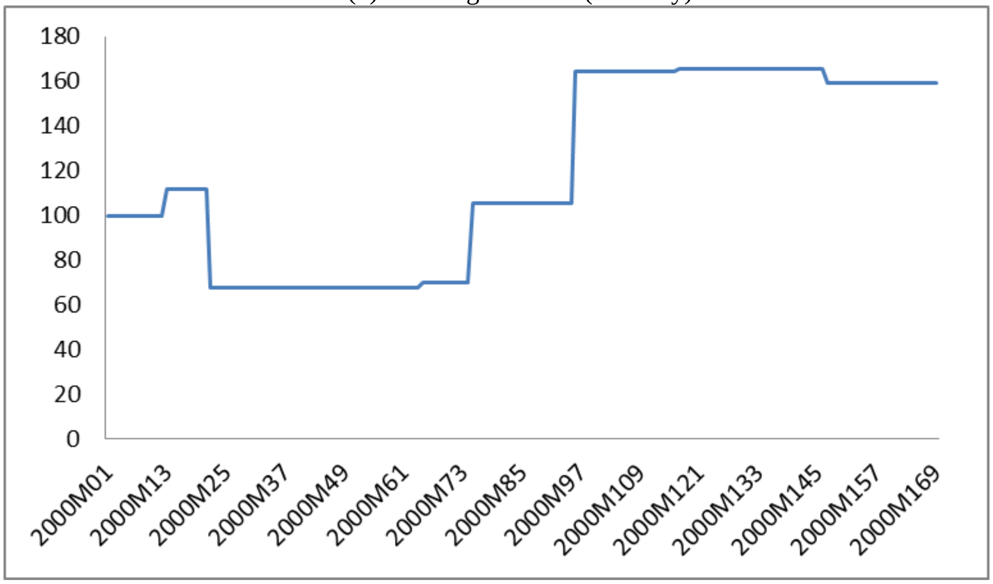


Figure 6.4: Profit/Loss Diagrams (Basic Trading Rule)—Oman

(a) Trading the USD (Monthly)



(b) Trading the GBP (Monthly)



(c) Trading the JPY (Monthly)

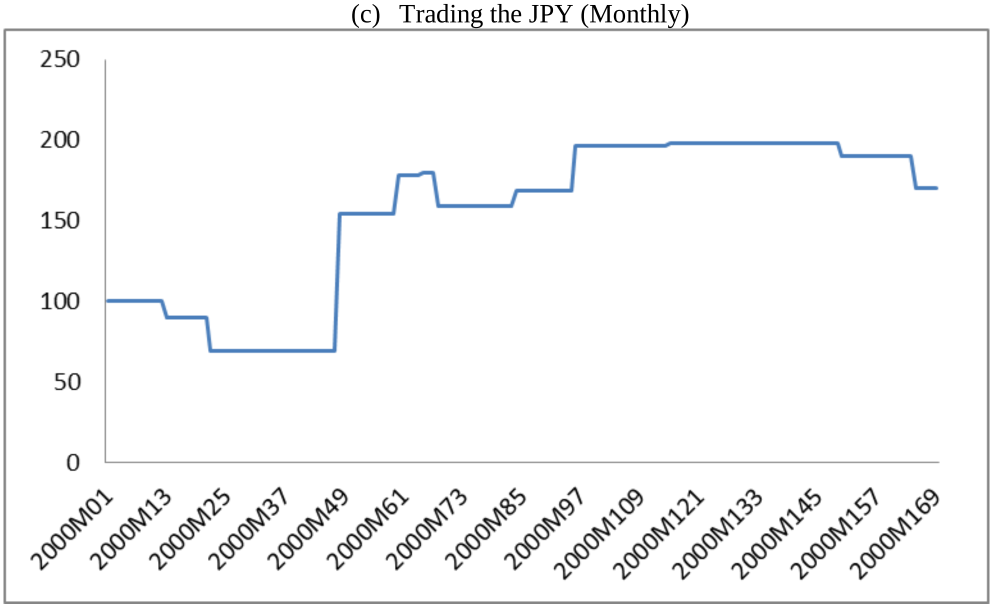
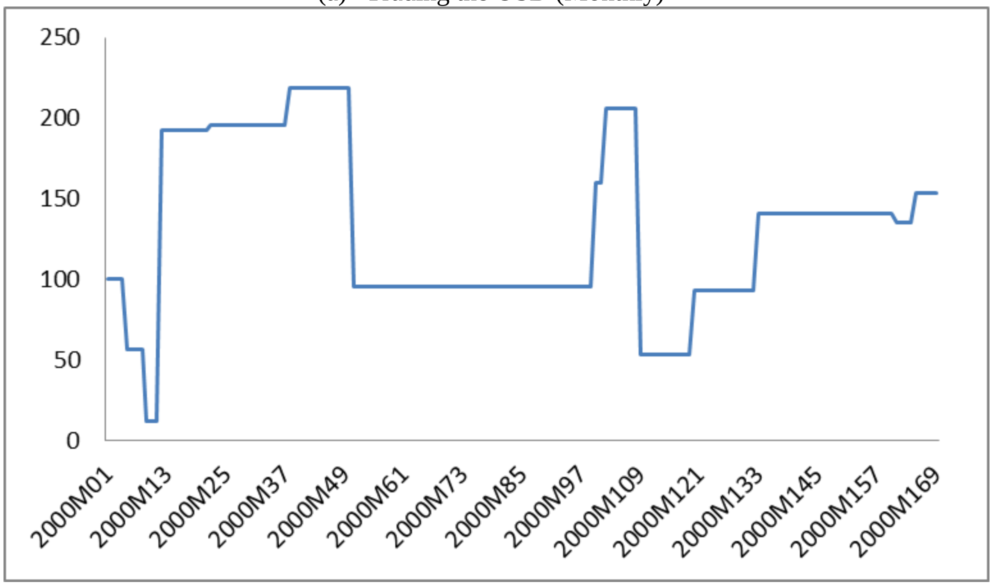
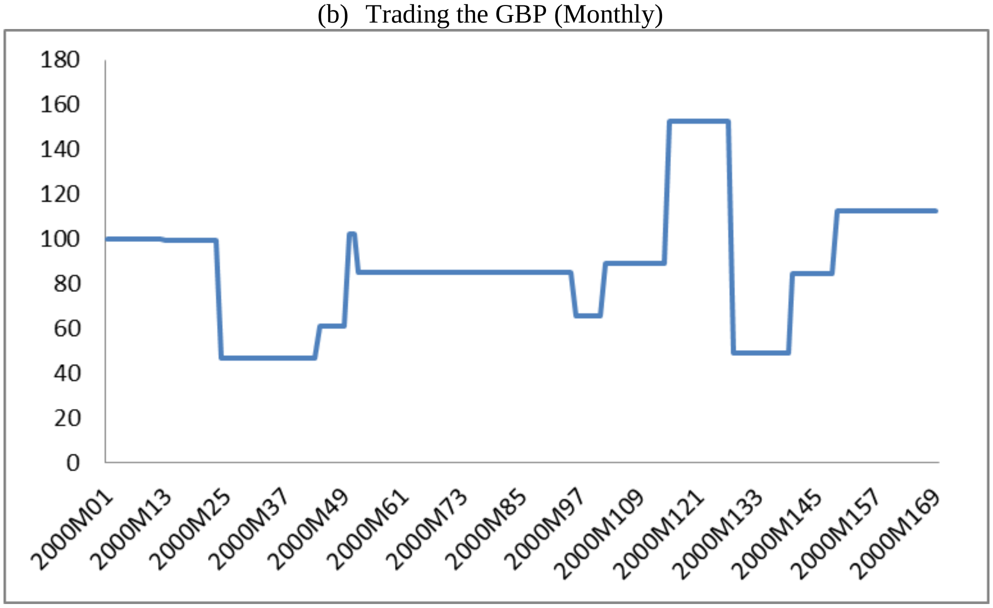


Figure 6.5: Profit/Loss Diagrams (Basic Trading Rule)—Qatar

(a) Trading the USD (Monthly)



(b) Trading the GBP (Monthly)



(c) Trading the JPY (Monthly)

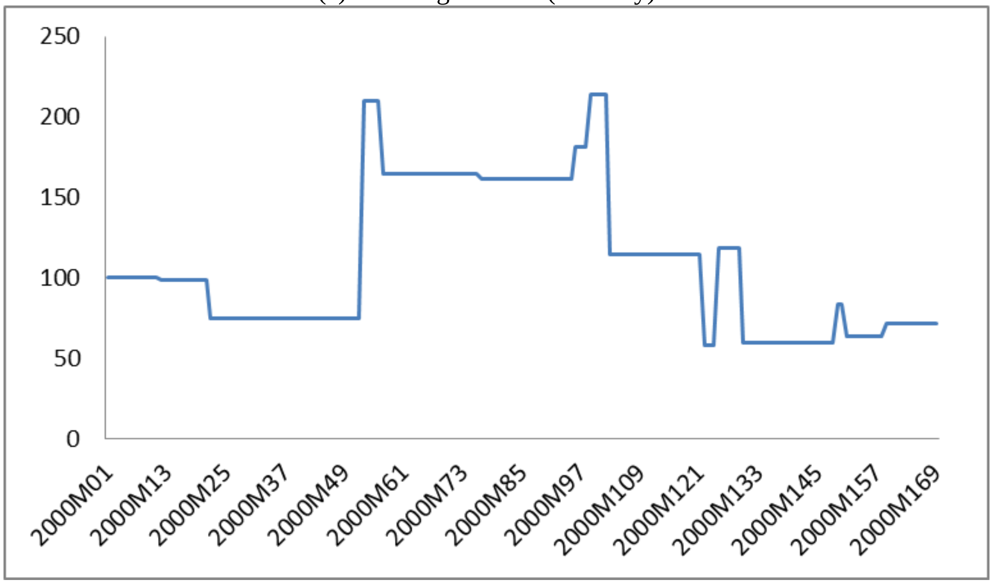
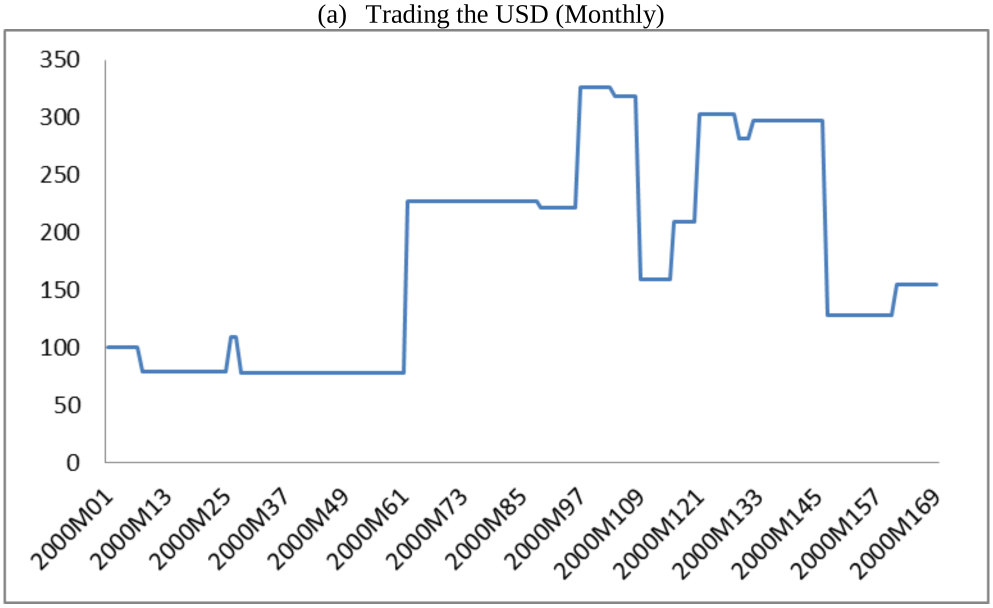
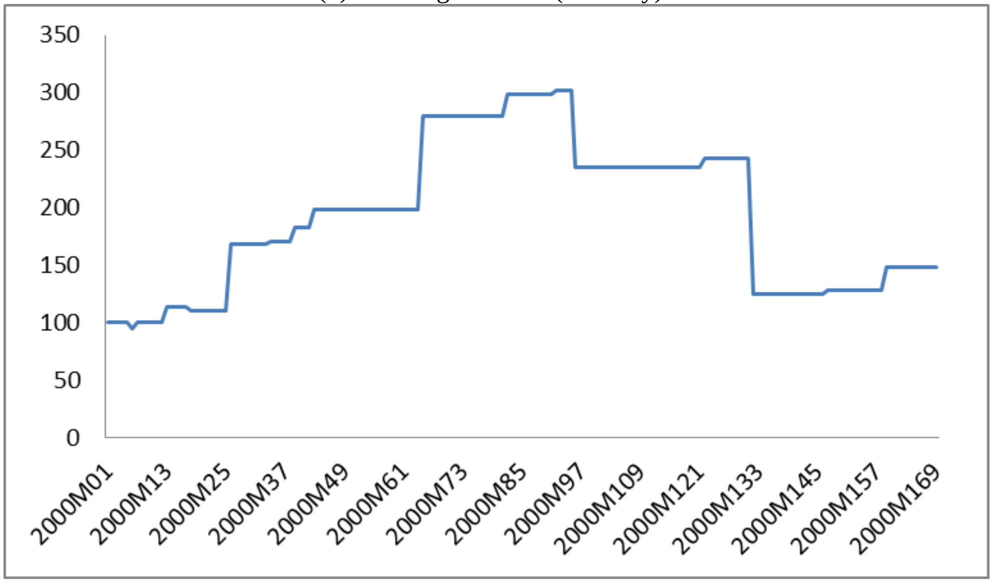


Figure 6.6: Profit/Loss Diagrams (Basic Trading Rule)—UAE

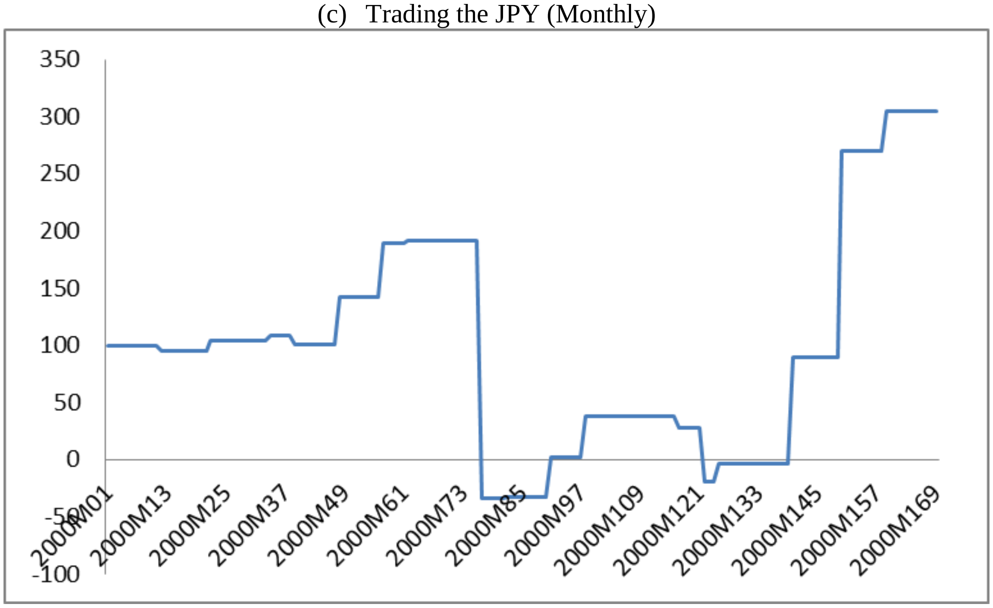
(a) Trading the USD (Monthly)



(b) Trading the GBP (Monthly)



(c) Trading the JPY (Monthly)



6.5 Conclusion

The aim of this study is to measure the profitability of stock trading in domestic (GCC) stock markets relative to foreign stock markets. The findings in this chapter revealed that a trading rule based on the basic trading formula is more profitable in domestic stock markets than in foreign exchange markets (US, UK and Japan). However, this finding cannot be generalised to any market and any period.

Chapter 7: International Portfolio Diversification from a GCC Perspective

7.1 Introduction

International diversification is considered a means of establishing greater efficiency within portfolios than solely using domestic assets. Numerous studies have identified international diversification as the most successful method for US investors to achieve an anticipated level of return for lower risk. Levy and Sarnat (1970) noted that investors can receive diversification benefits from investing in developed and developing countries' stocks. Grubel (1986) found that US investors would have achieved better risk-return opportunities by investing part of their portfolio in foreign stock markets during 1959–1966. In addition, Grubel and Fander (1971) demonstrated that industry connections with countries surpass industry connections across countries. This leads to the suggestion that reducing risk through the use of international diversification is best achieved when return correlations are low.[1] Other studies have put forward similar propositions, including Bailey and Stultz (1990), Odier and Solnik (1993), Doukas and Yung (1993), Chang et al. (1995), Solnik (1995,1997), Akdogan (1996), Michaud et al. (1996), De Santies and Gerard (1997), Griffin and Karolyi (1998) and Ang and Bekaert (2002).

Merkellos and Siriopoulous (1997) found that although there has been an increase in international integration, there is still potential for diversification into smaller and less obvious European stock markets. Gorman (1998) explored the idea that an everyday pension plan in the US is unlikely to be exposed to international equity, and that it would

[1] Goetzman et al. (2005) contended that international diversification benefits have been recognised for a long time, putting forward as a supportive argument the eighteenth-century development of Dutch mutual funds designed to hold international securities.

be beneficial for an increased number of investors to be assigned to international securities. Ang and Bekaret (2002) stated that the advantages of international diversification far outweigh the disadvantages, regardless of the risk of time-varying correlation. Moreover, many supporters of international diversification believe that emerging markets hold the answer to diversification. Conver et al. (2002) suggested that a US investor's portfolio of developed market equities can be positively affected through the inclusion of equities from emerging markets, and that the possible increases on returns can reach almost 1.5 percentage points per year. Russell (1998) echoed this point, stating that investment in emerging markets is a sound, albeit risky, approach to investment.

Although the benefits of diversification have been diminished by globalisation to a point where they can be gained mainly through investment in emerging markets, there is still a strong preference for local assets (Goetzmann et al. 2005). The predisposition towards domestic assets cannot be explained in terms of capital controls, tax burdens or transaction costs (French and Poterba 1991). Baxter and Jermann (1997) argued that although there has been a move towards further international diversification, the consistently high amounts of domestic holdings are inconsistent with the concept of portfolio choice. In addition, this is occurring regardless of further integration of capital markets. This practice appears to be widespread, with Australian investors also showing a reluctance to invest in foreign assets, which they consider risky. Wright and McCarthy (2002) wondered if this pattern indicates a lack of understanding among investors of the benefits to be gained through international corporations. Russel (1998) added that exchange-traded international securities, such as ADRs, are not the best means of achieving diversification. Therefore, is must be established why investors tend to apportion a great deal of their capital to domestic holdings, while international diversification provides seemingly substantial benefits. This has become known as the 'home bias puzzle' (Lewis 1999; Karolyi and Stulz 2003). Some economists have attempted to solve this puzzle in terms of barriers to international investment. Losq and Errunza (1985), Cooper and Kaplains (1994), Baxter and Jermann (1997), Stockman and Dellas (1989), Obstfeld and Rogoff (1998), Wheatley (2001) and Chan et al. (2005) discussed possible explanations such as deviations from purchasing power parity, the hedging of human capital and other non-traded assets, and familiarity with stock market developments. It has also been demonstrated that bias towards local assets is a regional trend rather than a purely international trend (Coval and Mostowitz 1999; Grinbaltt and Keloharju 2001).

The argument that international diversification does not provide returns, or that it is ineffective in reducing risk, may provide motivation for the preference for home-country holdings. Kalra et al. (2004) suggested that international securities could account for an approximate 10 per cent increase in returns, but that this is reduced, along with any benefits from international diversification, when taxes are taken into account. This being the case, there are fewer benefits to be gained from international diversification than was previously believed. To maintain a certain degree of diversification, the portfolio must be regularly rebalanced to keep domestic and overseas holdings at specific levels, as recommended by Laker (2003) and Rowland (1999). Further, the transaction costs associated with international investment in emerging markets must be taken into account when calculating the benefits to be gained from diversification. This may give the impression that international diversification will not be beneficial for an investor's portfolio.

7.2 Literature on International Diversification

Early research conducted in the 1960s and 1970s predominantly supported the benefits of international diversification. Grubel (1968), Levy and Sarnat (1970), Fander and Grubel (1971), Solnik (1974), Lassard (1976) and Begir (1979) demonstrated that international diversification provides US investors with a lower risk for a given level of expected return. For example, Grubel (1968) found that US traders could have achieved a better risk-return trade-off by investing part of their portfolio in foreign stock markets during 1958–1966. Sarnat and Levy (1970) demonstrated the diversification advantages of investing in both developing and developed stock markets during 1951–1967.

Several scholars have advocated diversification into emerging markets. For example, Conover et al. (2002) indicated that emerging stock markets represent a worthy addition to US investors' portfolio of developed market stocks. Specifically, they found that returns increase by approximately 1.6 percentage points a year when emerging country equities are included in the portfolio. Russel (1998) put forward a similar idea, stating that 'even the relatively risky practice of investing in emerging markets has been viewed, by some, as a sound investment strategy for individuals'. Goetzmann et al. (2005) argued that globalisation has resulted in limiting the benefits of diversification to the extent that it can best be achieved by investing in emerging stock markets. Laeven and Driessen (2007) found that investors in developing countries receive the most benefits from investing abroad. The implication of these studies is that the benefits of portfolio diversification accrue to investors from developed countries diversifying into emerging markets, and to investors from emerging countries diversifying into developed markets.

Several studies have been conducted on the phenomenon of home bias. Lewis (2006) described the tendency of investors to select a disproportionately high weight for domestic securities, thus foregoing gains from international diversification, as ‘one of the most enduring puzzles in international macroeconomics and finance’. French and Poterba (1991) found that home bias cannot be explained in terms of tax burden, transaction costs and capital controls. Jermann and Baxter (1997) argued that ‘while recent years have witnessed an increase in international diversification, holdings of domestic assets are still too high to be consistent with the theory of portfolio choice’.

Some researchers have cast doubt on the benefits of international diversification and suggested it as an explanation for home bias. For example, Kalra et al. (2004) found that there are fewer benefits of international diversification than previously thought. Their findings showed that a small allocation of 10 per cent to international securities may be justified, and that even the slight advantage of international diversification may disappear when taxes are incorporated in the evaluation. They also argued that to maintain the intended diversification, periodic rebalancing of the portfolio is necessary to keep the domestic and foreign component weights at target levels, as suggested by Rowland

(1999) and Laker (2003). However, international investment (particularly in emerging markets) involves non-trivial transaction costs that need to be considered when estimating portfolio performance. Thus, in the presence of periodic rebalancing and associated transaction costs, international diversification does not pay off. On the basis of her results, Lewis (2006) concluded that 'the benefits to diversification have declined both for stocks inside and outside the US'.

More recently, Moosa and Al-Deehani (2009) tested the proposition that international diversification is effective in reducing risk. Their analysis of more than 100 portfolios involving developed and emerging markets showed that correlations are not adequately low to produce effective diversification when long positions are taken. In a few cases involving developed markets only, correlations are high to the extent that taking opposite positions (long and short) produces effective diversification. These results cast doubt on the effectiveness of international diversification in reducing risk. Moosa and Ramiah (2014) and Moosa et al. (2014) reached similar conclusions.

However, many researchers support international diversification. Eichholtz (1996) found that higher expected returns are achieved on internationally diversified portfolios with less risk. Addae-Dapaah and Kion (1996) demonstrated the effectiveness of international real estate diversification and its ability to enhance portfolio efficiency. Gordon, Canter and Webb (1998) provided support for international diversification by analysing 40 countries and outlining the benefits of international diversification for securitised real estate portfolios. In contrast, Eichholtz, Huisman, Koedijk and Schuin (1998) utilised a multi-factor model and found that continental factors drive European countries, suggesting that portfolios should be diversified to achieve optimal benefits. Lui and Mei (1998) detected some diversification benefits by analysing possible integration across various real estate markets in the US, UK, Japan, France, South Africa and Australia. The study showed that the returns obtained by the investors were partially driven by exchange rate risk.

Stevenson (2001) examined international diversification and its benefits for 11 markets with the help of the Bayes–Stein shrinkage approach, which is designed to address estimation error issues as the parameter for input. The results showed a reduced variation of estimated portfolio allocation. Moreover, the estimated allocations were stabilised, and performance was improved by extenuating the estimation errors found from the sample means. Lizieri, McAllister and Ward (2003) conducted a test of integration on European equities from the perspective of a dollar-dominated investor and found low correlation across European securities. With the help of a Granger causality test and VARs, they concluded that there is lower explanatory power with stronger lead-lag relationships. The results also showed that slow integration is particularly related to the real estate securities market, which showed a potential diversification gain in the European market. Meyer and Shao (1995) analysed international venture capital portfolio diversification. Their results outlined the dynamics through which the flow of funds was analysed between different countries, as well as the benefits that were gained with the help of foreign capital. The results emphasised the requirement of companies that are sponsored by the government.

7.3 International Portfolio Diversification—Empirical Studies

7.3.1 Significance of International Portfolio Diversification

With the help of advanced technology and different means of communication, the benefits of international equity diversification have become apparent. As explained by French and Porteba (1991), the lack of diversification is a result of choices made by investors rather than constraints caused by institutions. Conversely, Allen (1991) noted that global investments could be problematic. Moreover, Allen summarised the various challenges faced by money managers, including the challenge of the unhedged dollar-dominated index and active managers' responsibility for making any kind of security selection. Another challenge is that the underweighting or overweighting of a country with respect to its index is actually related to the country's equity returns and expected currency returns. Further, the choice of portfolio selection and benchmark percentage to be hedged against currency fluctuations is made passively. Finally, currency-forward markets and their active utilisation cause portfolio returns to deviate from the benchmark percentage that is hedged passively.

Niendorf and Lang (1995) suggested that international equity mutual funds should be considered because they eradicate investors' hesitance and enhance risk-adjusted returns. Similarly, Grinold and Messe (2000) advocated strategic asset allocation in the case of international investment and found that large international investments are hedged mainly because portfolio managers are home biased. Evnine and Henriksson (1987) emphasised the power of successful market timing compared to the options used for the portfolio insurance strategy. Levy and Spector (1996) considered cross-asset diversification less powerful than time diversification. Further, they found that risky stocks should be considered in order to achieve a relatively lower risk and higher mean returns.

7.3.2 International Diversification in Emerging Markets

To determine the direction of international investors, various scholars have observed the flow of investment with respect to global portfolios. Khoury (2003) found that domestic funds have been outperformed by international funds and country-specific funds, advocating the allocation of 40–60 per cent of foreign securities to a typical portfolio. Bohn and Tesar (1996) found that US investors were only triggered by opportunities arising from different time variable investment plans. The same study also confirmed that US portfolios exhibit home bias. Bohn and Tesar (1996) evaluated financial liberalisation, which is considered a reason why emerging markets are increasingly flooded with capital flows. Improved information technology and financial products have enhanced the flow of capital from one financial market to another. Moreover, several financial products have been developed to facilitate investment in emerging markets. Fernhols and Hannon (1998) analysed investment with the help of diversity-weighted indexing. The index was considered beneficial for being inexpensive compared to the typical one-ended index. Moreover, it has been established that capital-weighted indices, such as the Russell 1000 and S&P 500, have been outperformed by professional portfolio managers. Further, indexing in emerging markets has grown rapidly. Indexing can be a form of ETFs or index funds that have grown substantially in terms of net assets. Tse and Martinez (2007) analysed the price discovery process of 24 international i-share funds (the first set of ETFs introduced by Barclays Global Advisors).

There are numerous reasons to explain why foreign investors have been hesitant to enter GCC equity markets. The trading cycle lacks operational transparency, as foreign investors cannot understand all of the steps required to open an account and clear, trade and settle transactions. Few of the key players are well informed about the GCC financial markets. The benefits of investment in the global context of the GCC have not been investigated. However, many investment banks and consulting firms understand the importance of research and development.

7.3.3 International Portfolio Diversification: GCC Perspective

Optimal management styles have evolved over time as a result of the increasing institutionalisation of local stock markets in GCC countries. As a result, fundamentals and market valuations are now closer to each other. According to Schwartz (1991), security prices have been less volatile with respect to the intraday trading intervals. This has been observed in light of increased institutionalisation.

In the GCC, it has been difficult to find a credible benchmark. However, a reasonable benchmark is the GCC stock exchange weighted index (except the Abu Dhabi market), which is widely used by mutual fund managers who are interested in investing in GCC markets. Moreover, some problems are associated with multi-asset specialised funds. Given the lack of benchmarks in five countries in the GCC (except the Abu Dhabi market), it is difficult to track the performance of various asset classes, including the real estate sector, private equity and corporate bonds.

Another issue pertains to sector indices. Existing indices do not have much information, and international standards are not followed. A partnership of Dow Jones and FTSE was established in 2005 to create industry classification benchmarks (ICB) to determine user-friendly and relevant classifications to assist global and local trading and decision making. In December 2013, 75,000 companies were listed in the ICB database. ICB indices are the international stock universe, which covers more than 7,900 securities markets in more than 45 countries, capturing 98 per cent of the world's investable market capitalisation. On the same grounds, a recent collaboration of a local investment companies with FTSE has been confirmed to implement the ICB standards. With the successful implementation of the benchmarking standards, market movements are better represented with the help of benchmarking standards and the comparison of GCC indices with a variety of other global indices.

7.3.4 International Diversification of Developed Markets

Madura and Soenen (1992) analysed the many benefits to be gained from international equity diversification from the perspective of eight international investors from the UK, Japan, France, the UK and Switzerland. Their analysis showed the lowest standard deviation and the average correlation coefficient that Japanese investors are likely to benefit from investments. Wilcox and Cavaglia (1997) analysed the perspective of European investors and outlined the benefits of international diversification. They showed that for a particular Dutch institutional portfolio, 25–30 per cent of foreign exposure is optimal. Moreover, Bugar and Maurer (2001) demonstrated the effectiveness of international diversification for hedging decisions. They concluded that, with the help of diversification, risk is reduced and return is maximised.

Tesar and Werner (1998) investigated the perspective of German investors on home bias, which had previously been confirmed by Cooper and Kaplanis (1994). French and Prateba (1991) also examined home bias, concluding that investors seek to hold a higher percentage of domestic rather than foreign assets. The findings also showed that overall portfolio risk is reduced with the help of politically risky countries in an international portfolio. With the help of cluster analysis, Diamond et al. (1997) tested the type of diversification by applying a bottom–up approach to 20 countries from three different regions. The results showed a tendency by fund managers towards sector diversification. Brooks and Del Negro (2005) investigated the country versus region effects on international stock portfolio diversification in three broad regions (Asia, the US and Europe) and MSCI indices. Their results showed equal importance for each region.

7.3.5 Empirical Evidence from Emerging Markets

Diversification among various emerging markets has been an important aspect over the past decade. The benefits of investing in emerging markets have been widely discussed, and they are well supported by the literature. It has been found that the involvement of emerging markets in the global context is beneficial, but there are higher average returns, a greater serial correlation, low correlation with developed markets and greater volatility. However, a question remains unanswered: How much should global portfolios invest in emerging markets? Speidall and Sapendielf (1992) advocated a 10–15 per cent investment in emerging markets as being consistent with risk tolerance and maximised returns.

Errunza (1994) generalised the findings of many researchers that they had identified in the previous three decades. Research aimed at comparing the return–risk characteristics in developed and emerging markets produced three main findings:

- Diversification in emerging markets is beneficial due to enhanced returns and reduced risk.
- Domestic systematic risk is higher in developed markets, but not much smaller in emerging markets.
- There is a low or even negative return correlation between both types of markets, whereas emerging markets are uncorrelated.

Errunza and Losq (1987) investigated three types of risks in emerging markets: currency, investment and political. These risks should be compensated for by excess returns on investments in emerging markets. Erb et al. (1995) researched the effect of country risk on global equity selection by investigating 21 emerging equity markets using data collected from the IFC index. The results showed that a major role is played by country credit ratings that have substantial predictive power for the determination of investment inflows. Bekaert et al. (1998) conducted quantitative analysis of emerging markets and found that returns were not non-normal. Of the 20 emerging markets, 17 showed positive skewness and 19 showed excess kurtosis. Bekaert and Urias (1999) analysed the benefits of international diversification into emerging markets from UK and US perspectives. The results showed positive results for the UK, but not for the US. Bey and Johnson (2006) found significant diversification benefits and suggested ways to indulge in short selling. Restrictions on short selling in emerging markets can be made less effective by developing a highly correlated short portfolio with US securities.

Mo and Chang (2005) applied a non-parametric cointegration test to investigate equity diversification benefits in Taiwan from the US and Japanese perspectives. The results showed that the Taiwanese stock market is parallel to the Japanese and US markets. Based on these findings, it was suggested that long-term diversification benefits are absent. Tanura et al. (2006) investigated the effect of adding the Chinese equity market to a globally diversified portfolio from the perspectives of the UK, US, France and Germany. The results showed that the inclusion of the Chinese equity market would eventually enhance returns rather than the higher risks associated with larger-than-normal volumes. Lagoarde-Segot and Lucey (2007) tested the implications of international portfolio diversification for the Middle East and North Africa regions.

7.4 International Diversification without Exchange Rates

As an investment strategy, it is believed that diversification can be beneficial. In particular, international diversification is viewed as an effective means of gaining returns on investments, as a combination of domestic and foreign assets has a lower correlation than purely domestic assets. This concept of low correlation lies at the centre of this argument. While the effect of currency should not be regarded as immaterial, the exchange rate factor is overlooked in this section while considering the returns achieved in local currency terms. This can be justified on the basis of one of the following assumptions: the exchange rate is fixed, the foreign currency position is entirely hedged and the foreign position is funded by the same foreign currency.

Suppose that an investor chooses positions on both a foreign market and a domestic market. The corresponding weights apportioned for each market are h and $1-h$ respectively. Therefore, the rate of return on the portfolio, $\mathrm{R_p}$, is a weighted average of the rates of return of both the domestic, $\mathrm{R_d}$, and foreign, $\mathrm{R_f}$, markets. The rate of return on the portfolio can be represented as:

$$R_p = hR_d + (1-h)R_f \tag{7.1}$$

The variance of the portfolio, σ_p^2, can be written as:

$$\sigma_\mathrm{p}^2 = \mathrm{h}^2\sigma_\mathrm{d}^2 + (1-\mathrm{h})^2\sigma_\mathrm{f}^2 + 2\mathrm{h}(1-\mathrm{h})\sigma_\mathrm{df} \tag{7.2}$$

where σ_d^2 and σ_f^2 are the variance rates of return on the domestic market and foreign market positions respectively, while $\sigma_\mathrm{d,f}$ is the covariance between the foreign and domestic rates of returns. As $\sigma_\mathrm{d,f} = \rho_\mathrm{d,f}\,\sigma_\mathrm{d}\,\sigma_\mathrm{f}$, ($\rho_\mathrm{d,f}$ is the correlation coefficient between the foreign and domestic rates of return, σ_d is the standard deviation of the domestic rate of return and σ_f is the standard deviation of the foreign rate of return), it follows that:

$$\sigma_\mathrm{p}^2 = \mathrm{h}^2\sigma_\mathrm{d}^2 + (1-\mathrm{h})^2\sigma_\mathrm{f}^2 + 2\mathrm{h}(1-\mathrm{h})\rho_\mathrm{df}\sigma_\mathrm{d}\sigma_\mathrm{f} \tag{7.3}$$

Equation (7.3) shows that the maximum risk reduction is obtained when $\rho_\mathrm{d,f} = -1$. Based on this equation, portfolio managers search for negatively correlated stock markets. As a result, portfolio managers begin to consider emerging equity markets that are negatively correlated with developed stock markets. However, many begin to question the sustainability of benefiting from international diversification with increased market integration and financial liberalisation. Baxter and Jerman (1997) found evidence of diminishing benefits of international diversification. Alternatively, Moosa and Al-Deehani (2006) argued that international diversification can still reduce risk when taking opposite positions. Assuming that short sales are available, an investor can take a long position in one market and a short position in the other. If an investor takes a long position on the domestic stock market and a short position on the foreign stock market, the portfolio rate of return can be computed as:

$$\mathrm{R_P} = \mathrm{hR_d} - (1 - \mathrm{h})\mathrm{R_f} \tag{7.4}$$

where the portfolio variance can be computed as:

$$\sigma_{\mathrm{P}}^2 = \mathrm{h}^2\sigma_{\mathrm{d}}^2 + (1 - \mathrm{h})^2\sigma_{\mathrm{f}}^2 - 2\mathrm{h}(1 - \mathrm{h})\rho_{d,f}\sigma_d\sigma_f \tag{7.5}$$

which means that risk reduction is maximised when $\rho_{d,f} = 1$.

Moosa and Al-Deehani (2006) noted that most studies on international diversification do not account for the statistical significance of correlation. Most studies have found numerical differences in standard deviations as a measure of risk reduction. Moosa and Al-Deehani (2006) suggest that testing the effectiveness of hedging should include the variance ratio test, in which the null hypothesis is $\sigma_d^2 = \sigma_p^2$.

7.5 Methodology

In this study, we investigate the effectiveness of international diversification in reducing risk as measured by the variance of the rate of return on the international portfolio. We concentrate on the presumed risk-reduction benefits of international diversification because risk diversification is more logical and can be used to present arguments in favour of foreign investment (McLeavey and Solinka 2004).

The main idea of risk-reduction hinges on a comparison between the variance of the rate of return on the international portfolio and the variance of the rate of return on the domestic portfolio (which is represented by the stock market index) consisting of either a short or long position on the foreign stock market and a short position on the domestic stock market. Whether a short or long position is taken on the foreign stock market depends on the correlation between the rates of return on the two markets.

The size of the position on the foreign market is determined by minimising the variance of the rate of return on the portfolio as follows:

$$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_{d,f} \tag{7.6}$$

Consider Equation (7.3), which defines the variance of the rate of return on the portfolio when similar positions are taken without considering the exchange rate factor. The value of h, which minimises the variance of the rate of return on the portfolio, can be obtained by differentiating the equation with respect to h to obtain:

$$\frac{\partial(\sigma_p^2)}{\partial h} = 2h\sigma_d^2 - 2(1-h)\sigma_f^2 + 2(1-h)\sigma_{d,f} \tag{7.7}$$

which is then equated to 0 to obtain:

$$h\left(\sigma_d^2 + \sigma_f^2 - \sigma_{d,f}\right) = \sigma_f^2 \tag{7.8}$$

Hence:

$$h = \frac{\sigma_f^2}{(\sigma_d^2+\sigma_f^2-\sigma_{d,f})} \quad (7.9)$$

Likewise, we can compute the value of h for the other three cases. Table 7.1 presents the formulas used to compute R_p, σ_p^2 and h as follows:

- Case 1: similar positions without considering the exchange rate factor
- Case 2: opposite positions without considering the exchange rate factor
- Case 3: similar positions with the exchange rate factor
- Case 4: opposite positions with the exchange rate factor.

Table 7.1: Return on Portfolio, Variance of Portfolio and Hedge Ratio

Case	R_p	σ_p^2	h
1	$R_p = hR_d + (1-h)R_f$	$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2 + 2h(1-h)\,\rho_{d,f}\sigma_d\sigma_f$	$h = \frac{\sigma_f^2}{(\sigma_d^2+\sigma_f^2-\sigma_{d,f})}$
2	$R_p = hR_d - (1-h)R_f$	$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2 - 2h(1-h)\,\rho_{d,f}\sigma_d\sigma_f$	$h = \frac{\sigma_f^2}{(\sigma_d^2+\sigma_f^2+\sigma_{d,f})}$
3	$R_p = hR_d + (1-h)R_{f*}$	$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2 + 2h(1-h)\,\rho_{d,f*}\sigma_d\sigma_{f*}$	$h = \frac{\sigma_{f*}^2}{(\sigma_d^2+\sigma_f^2-\sigma_{d,f*})}$
4	$R_p = hR_d - (1-h)R_{f*}$	$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2 - 2h(1-h)\,\rho_{d,f*}\sigma_d\sigma_{f*}$	$h = \frac{\sigma_{f*}^2}{(\sigma_d^2+\sigma_f^2+\sigma_{d,f*})}$

Once the variances of the rates of return are computed, the effectiveness of international diversification in reducing risk is based on the null hypothesis:

$$H_0: \sigma_d^2 = \sigma_p^2 \quad (7.10)$$

whereas the alternative hypothesis of effective hedging is:

$$H_1: \sigma_d^2 > \sigma_p^2 \quad (7.11)$$

If the value of the variance of domestic market $\sigma^2(R)$ is larger than the variance of the rate of return of portfolio $\sigma^2(R_p)$, the null hypothesis will be rejected. This implies that diversification is effective in reducing risk if:

$$VR = \frac{\sigma_d^2}{\sigma_p^2} > F(n-1, n-1) \tag{7.12}$$

where *VR* is the variance ratio and *n* is the sample size. This test is complemented by calculating the variance reduction, *VD*, as follows:

$$VD = 1 - \frac{1}{VR} \tag{7.13}$$

Whether the null hypothesis is rejected depends crucially on $\rho_{d,f}$, which can be shown as follows for the case of similar positions without the exchange rate factor. When similar positions are taken, *VR* can be expressed as:

$$VR = \frac{\sigma_d^2}{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}} \tag{7.14}$$

This shows that a high negative value for the correlation coefficient produces a high *VR*. The same is true for all other cases. Therefore:

$$VD = 1 - \frac{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2} \tag{7.15}$$

This means that a large negative value of the correlation coefficient produces high variance reduction. Table 7.2 presents the formulas that are used to calculate VR and VD in the four cases considered.

Table 7.2: Calculation VR and VD

	VR	VD
1	$VR = \frac{\sigma_d^2}{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}$	$VD = 1 - \frac{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2}$
2	$VR = \frac{\sigma_d^2}{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 - 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}$	$VD = 1 - \frac{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2}$
3	$VR = \frac{\sigma_d^2}{h^2\sigma_d^2 + (1-h)^2\,\sigma_{f*}^2 + 2h\,(1-h)\sigma_d\sigma_{f*}\rho_{d,f*}}$	$VD = 1 - \frac{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2}$
4	$VR = \frac{\sigma_d^2}{h^2\sigma_d^2 + (1-h)^2\,\sigma_{f*}^2 - 2h\,(1-h)\sigma_d\sigma_{f*}\rho_{d,f*}}$	$VD = 1 - \frac{h^2\sigma_d^2 + (1-h)^2\,\sigma_f^2 + 2h\,(1-h)\sigma_d\sigma_f\rho_{d,f}}{\sigma_d^2}$

7.6 Data

The empirical results are based on monthly data for three developed countries (the US, UK and Japan [JAP]) and six emerging financial markets (Kingdom of Arabia Saudi [KSA], UAE, Kuwait [KUW], Qatar [QAR], Bahrain [BAH] and Oman [OMN]). The data series cover the period January 2000 to December 2013.

The choice of these countries is highly relevant to the issue of international diversification. The GCC countries are significant oil producers, so their markets should be positively affected by any rise or fall in oil prices. The GCC countries produced around 24 per cent of the world's total crude oil in 2013. The developed market prices are represented respectively by the S&P 500, the London Stock Exchange index and the Tokyo Stock Price index. Data were obtained from Datastream and the IMF's International Financial Statistics.

7.7 International Diversification without Exchange rates: Results

We first start by considering the rates of return in the country's own currency without taking into account changes in exchange rates. This is a legitimate procedure if foreign exchange risk can be eliminated completely by covering the foreign position in the forward market or by funding the foreign portfolio in the same currency. Table 7.3 shows the correlation matrix of the rates of return without the exchange rate factor. Evidently, the correlations between the developed markets and emerging markets are all positive and statistically significant, except between the UK and Qatar markets. Further, Table 7.3 shows low correlations between returns in developed markets and returns in emerging markets. In this respect, long positions in the developed and emerging markets should reduce risk. High correlations can be found between returns in developed markets, especially between the Japanese and US markets and between Japan and the UK. In this respect, opposite positions must be taken in both markets to reduce risk.

Table 7.3: Correlation Matrix of Rates of Return without the Exchange Rate Factor

	KUW	KSA	BAH	OMN	QAT	UAE	USA	UK	JAP
KUW	1								
KSA	0.29	1							
BAH	0.42	0.09	1						
OMN	0.11	0.31	0.16	1					
QAT	0.21	0.31	0.11	0.41	1				
UAE	0.15	0.34	0.21	0.41	0.44	1			
USA	0.15	0.18	0.11	0.13	0.02	0.07	1		
UK	0.12	0.24	0.09	0.09	-0.01	0.01	0.84	1	
JAP	0.16	0.30	0.10	0.10	0.11	0.11	0.51	0.58	1

Figures 7.1 (a) and 7.1 (b) display plots of the variance ratio $\left(\sigma_d^2/\sigma_f^2\right)$ corresponding to the six portfolios. The horizontal line defines the 5 per cent critical value of VR (1.687) such that a significant variance ratio that indicates effective diversification appears above the horizontal line. As shown in Figure 7.1(a), four out of six possible portfolios are above the horizontal line of critical value when similar positions are taken. However, Figure 7.1(b) shows that all six cases produce effective diversification when the opposite positions are taken. This is because the high correlations between developed markets are positive, which means that effective diversification appears only in developed markets when opposite positions are taken.

Tables 7.4 and 7.5 display the underlying calculations of the portfolios represented in Figures 7.2(a) and 7.1(b). As shown, the findings confirm that when opposite positions are taken, the variance reduction ranges from 75.5 per cent to 86.2 per cent. The 86.2 per cent variance reduction is witnessed when taking a long position on the Japanese market and a short position on the US market. Thus, it can be concluded that:

1. Only opposite positions produce risk reduction because the correlations are positive and statistically significant.
2. Effective diversification only involves developed markets in which stock returns are highly correlated.

Tables 7.4 and 7.5 display the findings of the variance reduction test on the three markets.

Table 7.4: Effective Diversification with Short Position on the Foreign Market

Domestic Market	Foreign Market	σ_d^2	σ_p^2	VR	VD
US	UK	0.0000223	0.0000198	1.1243499	0.1105972
US	JAP	0.0000223	0.0000219	1.0176164	0.0173115
UK	US	0.0000294	0.0000163	1.7997117	0.4443555
UK	JAP	0.0000294	0.0000162	1.8105497	0.4476815
JAP	US	0.0000578	0.0000218	2.6545233	0.6232845
JAP	UK	0.0000578	0.0000337	1.7141488	0.4166201

Table 7.5: Effective Diversification with Long Position on the Foreign Market

Domestic Market	Foreign Market	σ_d^2	σ_p^2	VR	VD
US	UK	0.0000223	0.0000050	4.4973997	0.7776493
US	JAP	0.0000223	0.0000055	4.0704657	0.7543279
UK	US	0.0000294	0.0000041	7.1988469	0.8210889
UK	JAP	0.0000294	0.0000041	7.2421987	0.8619204
JAP	US	0.0000578	0.0000054	10.6180930	0.8058211
JAP	UK	0.0000578	0.0000084	6.8565954	0.8541550

Figure 7.1: Variance Ratios against the 5% Critical Value

(a) Similar Positions (b) Opposite Positions

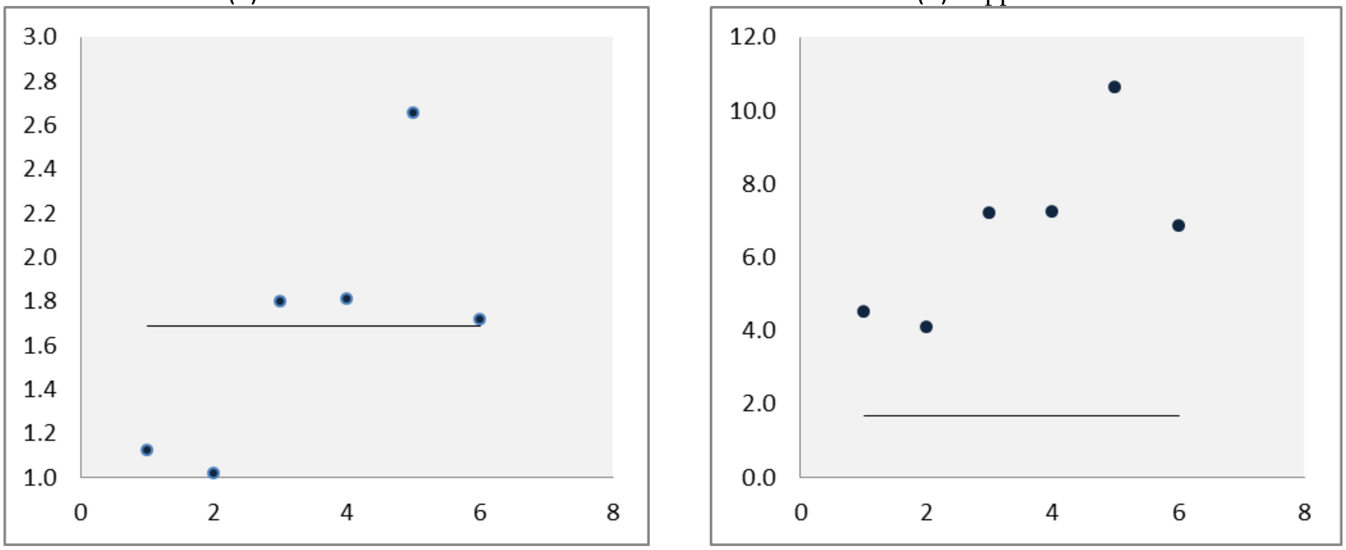
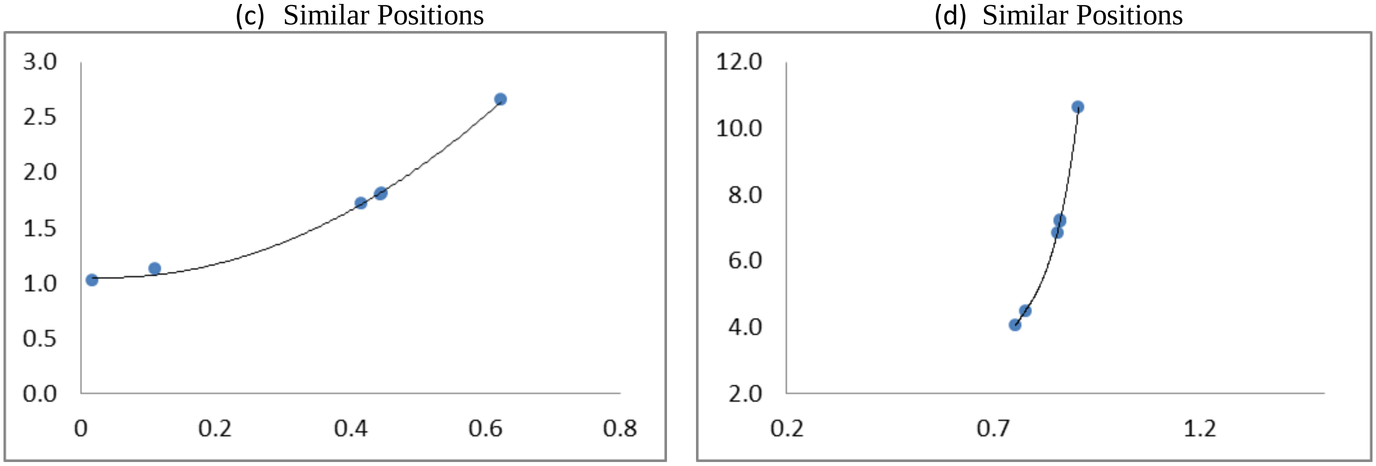


Figure 7.2: Variance Reduction as a Function of the Variance Ratio

(c) Similar Positions (d) Similar Positions



In the case of emerging markets, Figures 7.3–7.16 show plots of the variance ratios relating to the 35 possible portfolios. The horizontal axis represents the 5 per cent critical value (VR=1.687), such that a significant variance ratio is plotted above the line. As shown in Figures 7.5–7.16, not all of the data points of possible portfolios are above the horizontal line when similar positions are taken. However, all 35 cases produce effective diversification, as all possible portfolios are above the horizontal line.

Tables 7.6 and 7.7 report the underlying calculations of the portfolios represented in Figures 7.5–7.16. The findings confirm that when opposite positions are taken, variance reduction ranges between 33.0 per cent and 90.6 per cent. The maximum value of variance reduction (90.6 per cent) is obtained when taking a long position in Qatar and a short position in Bahrain. All of the findings of the variance reduction test on the six markets are reported in Tables 7.6 and 7.7.

One portfolio—namely that where the domestic stock market is Bahrain and the foreign market is Kuwait—produces an inconclusive diversification effect, as the VR is the same at the 5 per cent critical value. Moreover, the following three portfolios have a lower VR than the 5 per cent critical value:

1. When Kuwait is the domestic market and Bahrain is the foreign stock market—that is, when a long position is taken on the Kuwait market and a short position is taken on the Bahrain market.
2. When Saudi Arabia is the domestic market and Bahrain is the foreign market—that is, when a long position is taken on the Saudi market and a short position is taken on the Bahrain market.
3. When Saudi Arabia is the domestic market and the UAE is the foreign market—that is, when a long position is taken on the Saudi Arabia market and a short position is taken on the UAE market.

The findings in all six cases reveal effective diversification benefits in the GCC stock markets and when opposite positions are taken. Thus, it can be concluded that GCC countries still provide effective diversification.

Table 7.6: Effective Diversification with Short Position on the Emerging Market

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	KSA	0.0001005	0.0000677	1.4855983	0.3268705
KUW	BAH	0.0001005	0.0001282	1.2747100*	0.2155079
KUW	OMN	0.0001005	0.0000315	3.1966251	0.6871701
KUW	QAR	0.0001005	0.0000663	1.5171248	0.3408585
KUW	UAE	0.0001005	0.0000482	2.0862649	0.5206745
Panel B					
KSA	KUW	0.0000735	0.0000447	1.6449966	0.3920960
KSA	BAH	0.0000735	0.0000860	1.1696333	0.1450312
KSA	OMN	0.0000735	0.0000367	2.0008126	0.5002031
KSA	QAR	0.0000735	0.0000820	1.1161660*	0.1040759
KSA	UAE	0.0000735	0.0000442	1.6617173	0.3982129
Panel C					
BAH	KUW	0.0001210	0.0001117	1.0836990	0.0772345
BAH	KSA	0.0001210	0.0001014	1.1931769	0.1619013
BAH	OMN	0.0001210	0.0001032	1.1729799	0.1474704
BAH	QAR	0.0001210	0.0001191	1.0159506	0.0157002
BAH	UAE	0.0001210	0.0001182	1.0242770	0.0237016
Panel D					
OMN	KUW	0.0000406	0.0000311	1.3058792	0.2342324
OMN	KSA	0.0000406	0.0000382	1.0627457	0.0590411
OMN	BAH	0.0000406	0.0000259	1.5673642	0.3619862
OMN	QAR	0.0000406	0.0000262	1.5486956	0.3542953
OMN	UAE	0.0000406	0.0000288	1.4075401	0.2895407
Panel E					
QAR	KUW	0.0000852	0.0000514	1.6594926	0.3974062
QAR	KSA	0.0000852	0.0000649	1.3133256	0.2385742
QAR	BAH	0.0000852	0.0000321	2.6592020	0.6239473
QAR	OMN	0.0000852	0.0000478	1.7848035	0.4397142
QAR	UAE	0.0000852	0.0000451	1.8888581	0.4705796
Panel F					
UAE	KUW	0.0000775	0.0000440	1.7630359	0.4327966
UAE	KSA	0.0000775	0.0000397	1.9535142	0.4881020
UAE	BAH	0.0000775	0.0000628	1.2335006	0.1892991
UAE	OMN	0.0000775	0.0000687	1.1274565	0.1130478
UAE	QAR	0.0000775	0.0000327	2.3732442	0.5786359

Table 7.7: Effective Diversification with Long Position on the Emerging Market

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	KSA	0.0001005	0.0000338	2.9711967	0.6634353
KUW	BAH	0.0001005	0.0000641	1.5689843	0.3626450
KUW	OMN	0.0001005	0.0000157	6.3932502	0.8435850
KUW	QAR	0.0001005	0.0000331	3.0342497	0.6704292
KUW	UAE	0.0001005	0.0000241	4.1725297	0.7603372
Panel B					
KSA	KUW	0.0000735	0.0001128	1.5355648	0.3487738
KSA	BAH	0.0000735	0.0000201	3.6623354	0.7269502
KSA	OMN	0.0000735	0.0000238	3.0897952	0.6763539
KSA	QAR	0.0000735	0.0000357	2.0586731	0.5142502
KSA	UAE	0.0000735	0.0000492	1.4926490	0.3300501
Panel C					
BAH	KUW	0.0001210	0.0000670	1.6806165	0.4463407
BAH	KSA	0.0001210	0.0000251	4.8275444	0.7928554
BAH	OMN	0.0001210	0.0000262	4.6268840	0.7838718
BAH	QAR	0.0001210	0.0000260	4.6629893	0.7855453
BAH	UAE	0.0001210	0.0000279	4.3446997	0.7698345
Panel D					
OMN	KUW	0.0000406	0.0000117	3.4823445	0.7128371
OMN	KSA	0.0000406	0.0000095	4.2509828	0.7647603
OMN	BAH	0.0000406	0.0000162	2.5077827	0.6012414
OMN	QAR	0.0000406	0.0000157	2.5811594	0.6125772
OMN	UAE	0.0000406	0.0000072	5.6301604	0.8223852
Panel E					
QAR	KUW	0.0000852	0.0000128	6.6379706	0.8493515
QAR	KSA	0.0000852	0.0000162	5.2533022	0.8096435
QAR	BAH	0.0000852	0.0000080	10.6368079	0.9059868
QAR	OMN	0.0000852	0.0000119	7.1392141	0.8599286
QAR	UAE	0.0000852	0.0000113	7.5554322	0.8676449
Panel F					
UAE	KUW	0.0000775	0.0000110	7.0521436	0.8581991
UAE	KSA	0.0000775	0.0000317	2.4418927	0.5904816
UAE	BAH	0.0000775	0.0000157	4.9340023	0.7973248
UAE	OMN	0.0000775	0.0000172	4.5098258	0.7782619
UAE	QAR	0.0000775	0.0000392	1.9777035	0.4943630

Figure 7.3: Variance Ratio against the 5% Critical Value—Kuwait Perspective

(a) Similar Positions (b) Opposite Positions

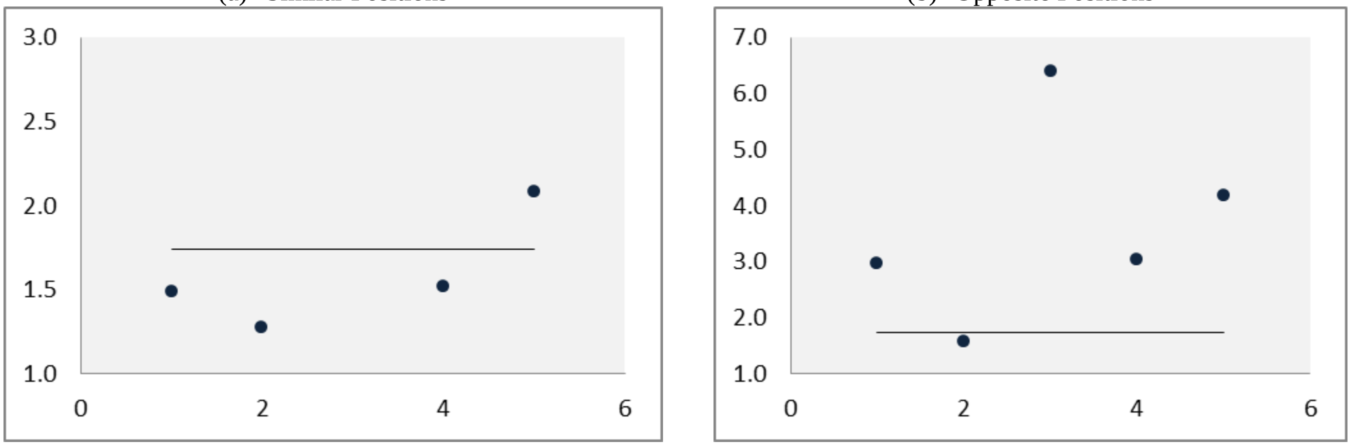


Figure 7.4: Variance Reduction as a Function of the Variance Ratio—Kuwait Perspective

(a) Similar Positions (b) Opposite Positions

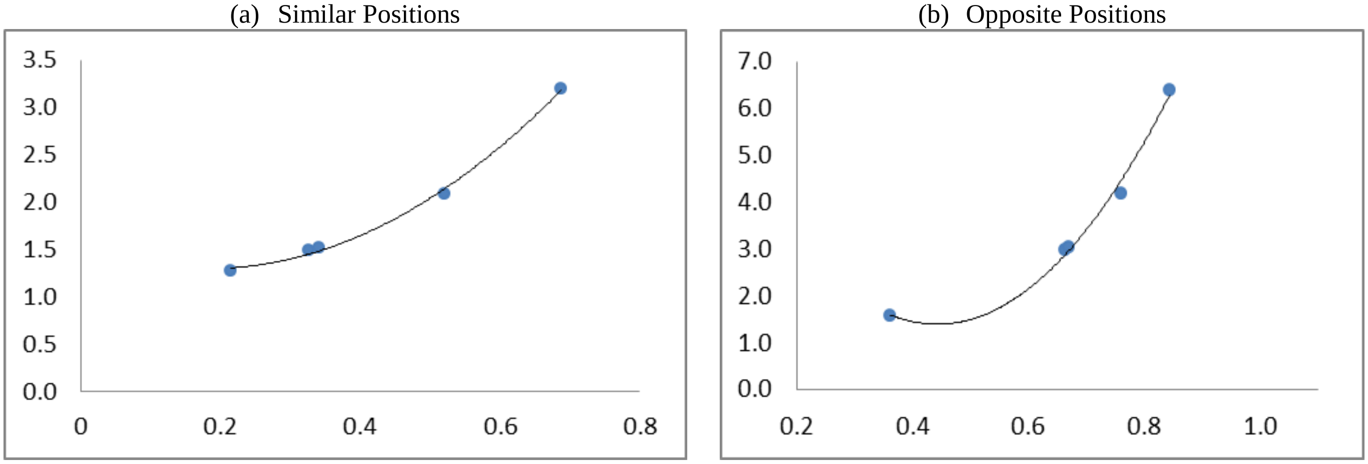


Figure 7.5: Variance Ratio against the 5% Critical Value—KSA Perspective

(a) Similar Positions (b) Opposite Positions

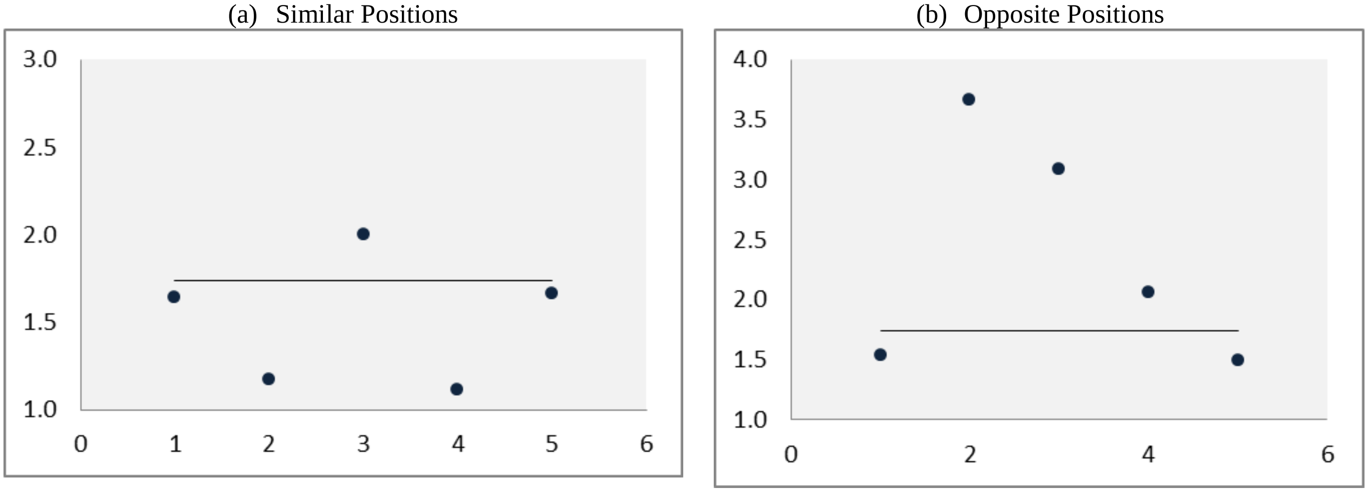
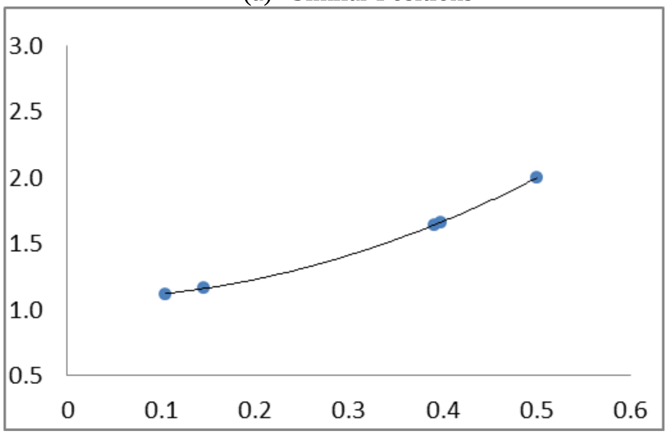


Figure 7.6: Variance Reduction as a Function of the Variance Ratio—KSA Perspective

(a) Similar Positions



(b) Opposite Positions

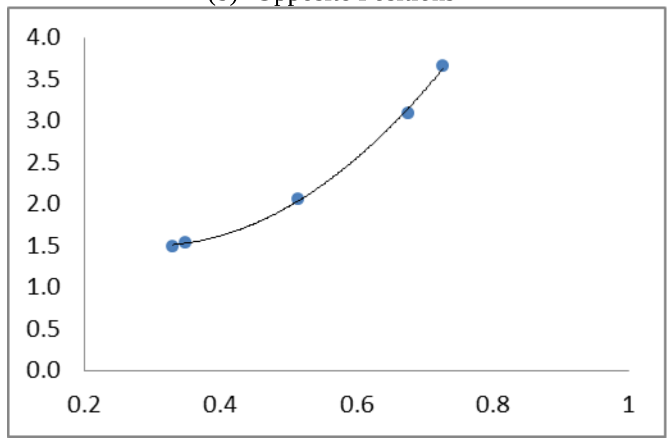
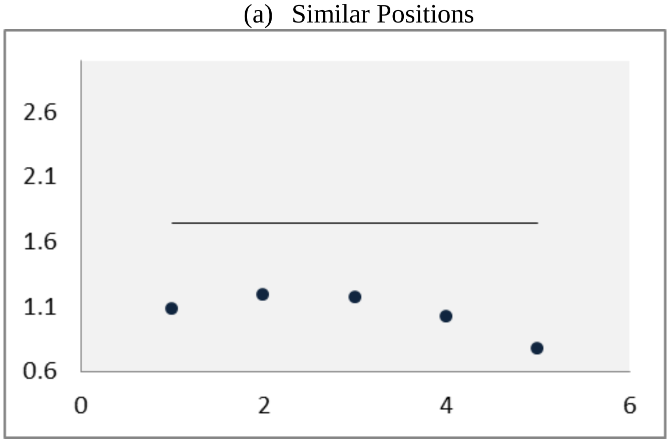


Figure 7.7: Variance Ratio against the 5% Critical Value—Bahrain Perspective

(a) Similar Positions



(b) Opposite Positions

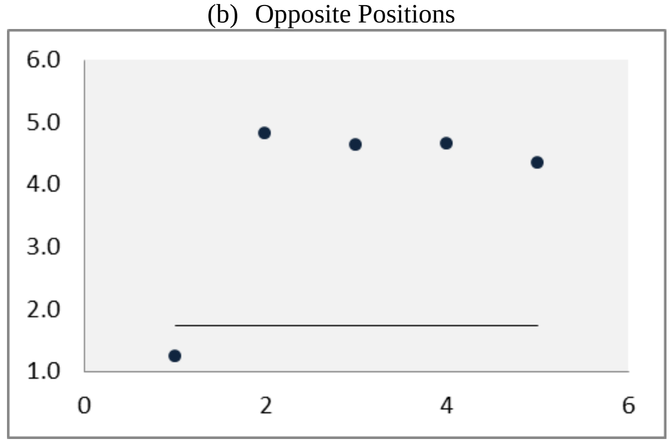
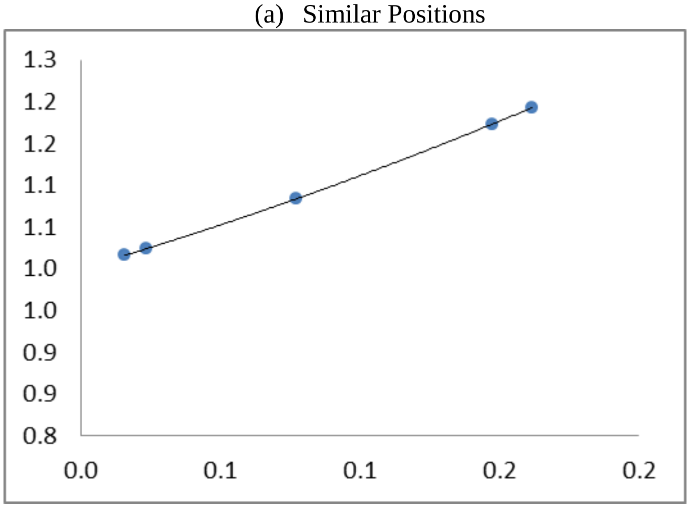


Figure 7.8: Variance Reduction as a Function of the Variance Ratio—Bahrain Perspective

(a) Similar Positions



(b) Opposite Positions

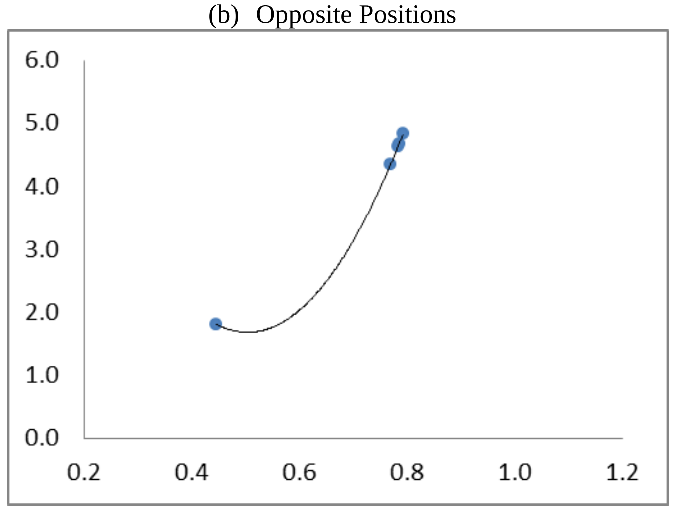


Figure 7.9: Variance Ratio against the 5% Critical Value—Oman Perspective

(a) Similar Positions (b) Opposite Positions

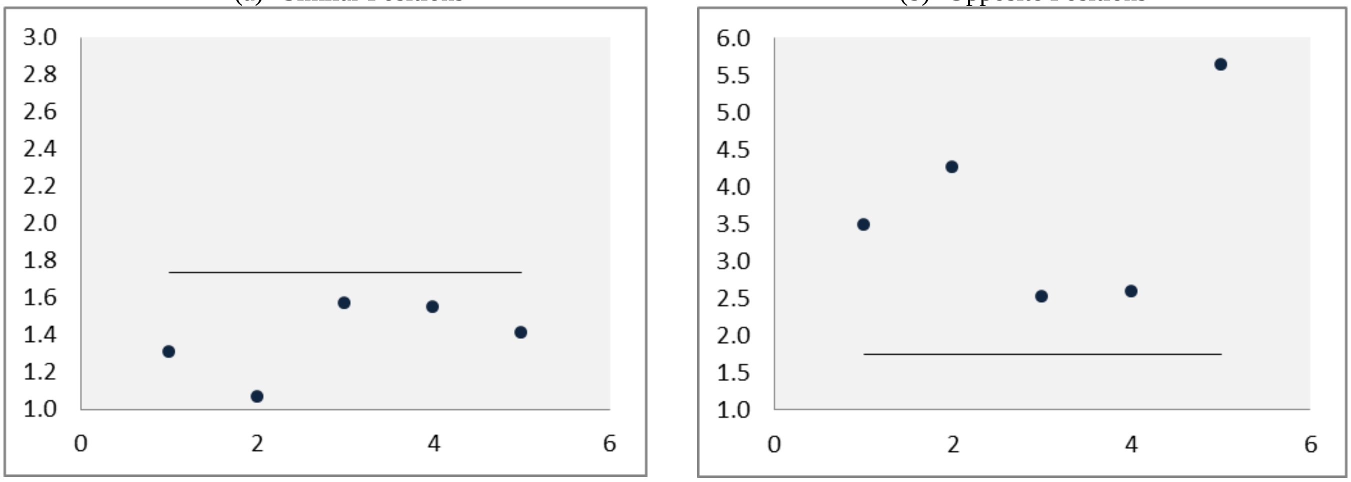


Figure 7.10: Variance Reduction as a Function of the Variance Ratio—Oman Perspective

(a) Similar Positions (b) Opposite Positions

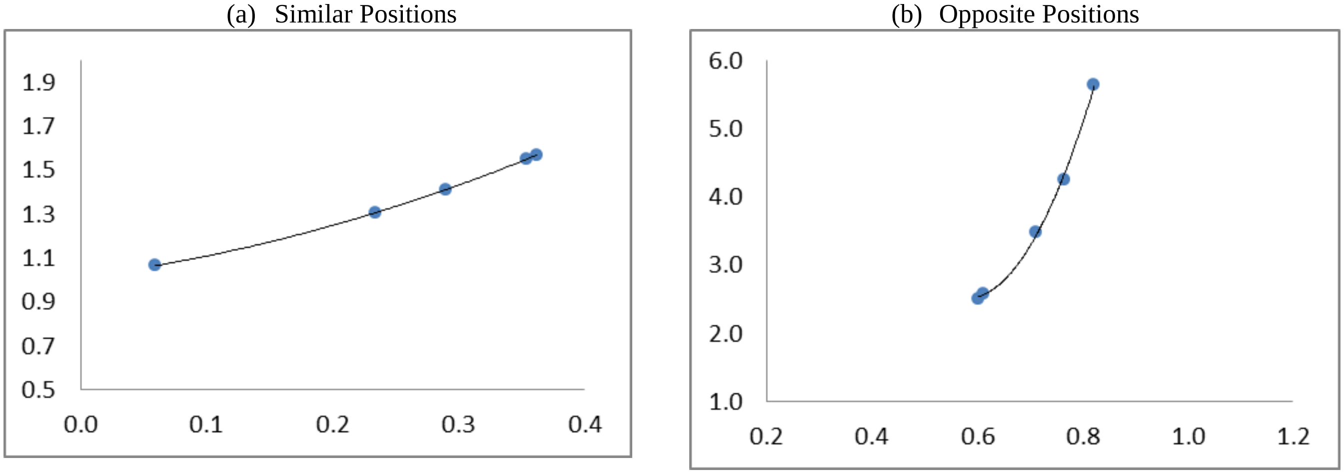


Figure 7.11: Variance Ratio against the 5% Critical Value—Qatar Perspective

(a) Similar Positions (b) Opposite Positions

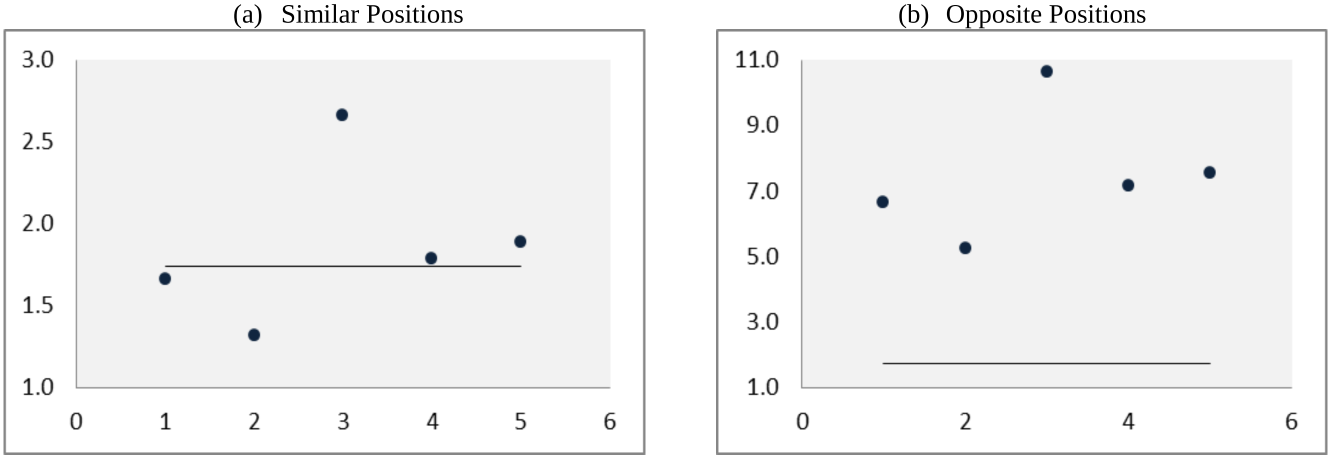
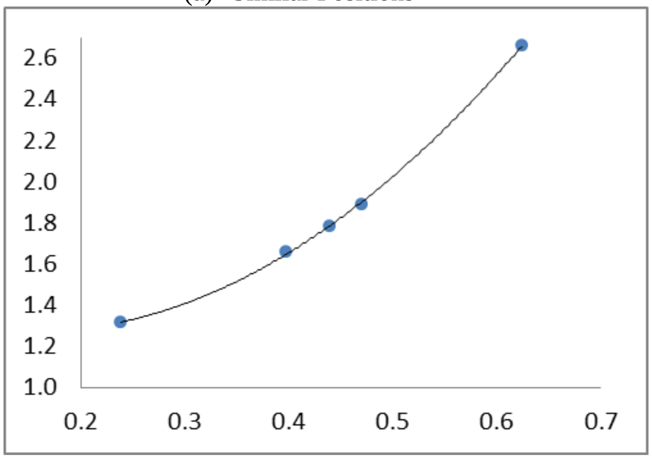


Figure 7.12: Variance Reduction as a Function of the Variance Ratio—Qatar Perspective

(a) Similar Positions



(b) Opposite Positions

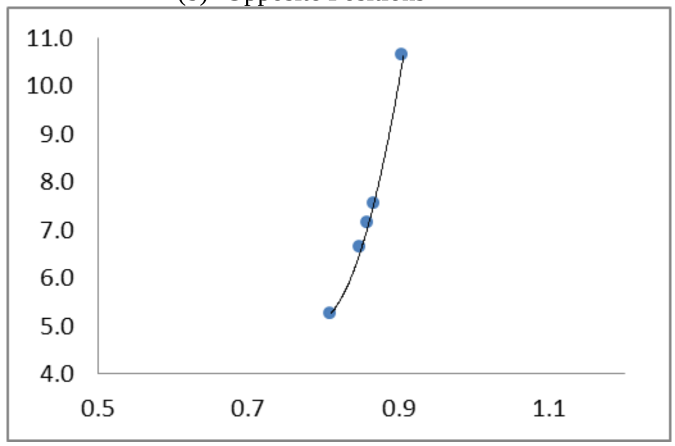
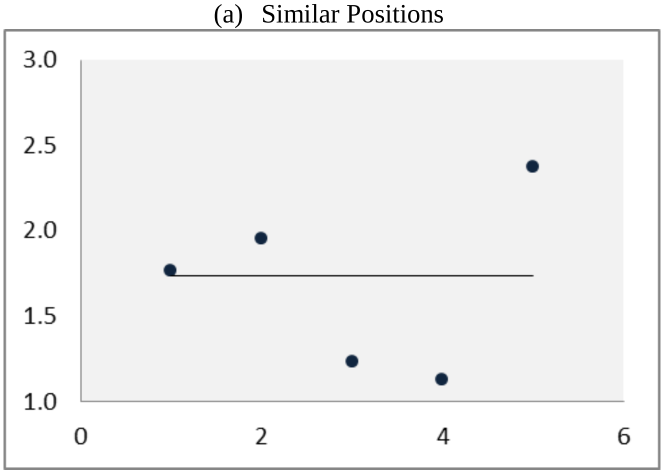


Figure 7.13: Variance Ratio against the 5% Critical Value—UAE Perspective

(a) Similar Positions



(b) Opposite Positions

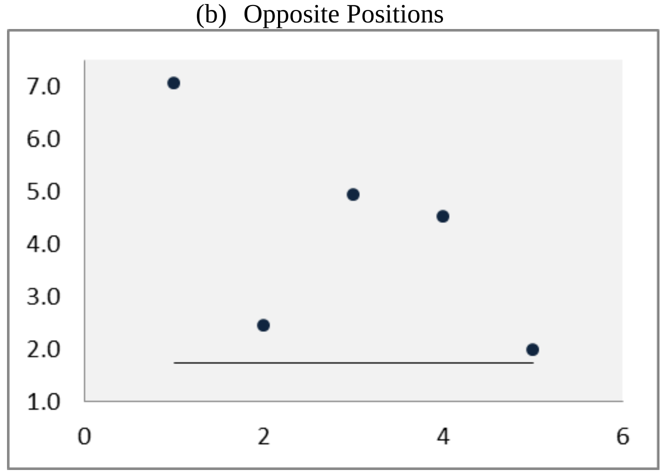
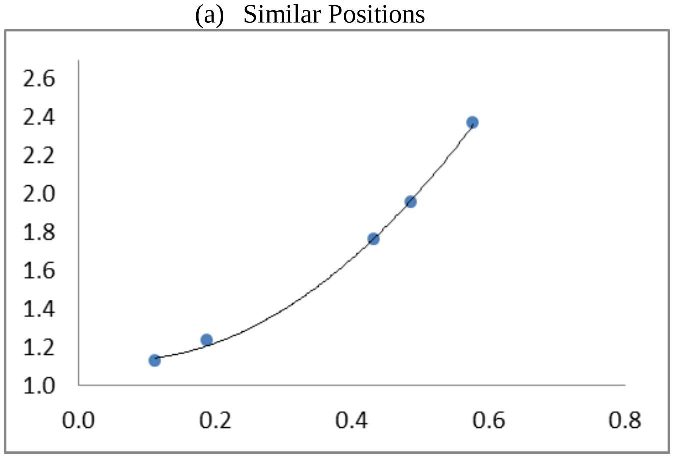
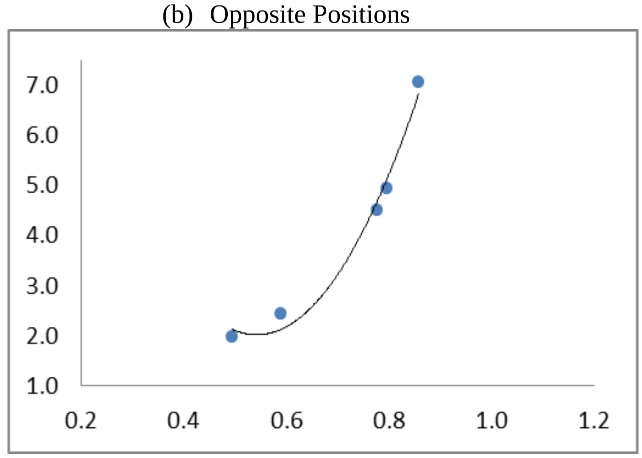


Figure 7.14: Variance Reduction as a Function of the Variance Ratio—UAE Perspective

(a) Similar Positions



(b) Opposite Positions



When the emerging countries are domestic markets and the developed countries are foreign markets, there are few data points above the horizontal line when similar positions are taken, as shown in Figures 7.17–7.28 (variance ratio against the 5 per cent critical value). However, all of the data points are above the horizontal line when long positions are taken. Tables 7.8 and 7.9 display the underlying calculations of the portfolio represented in Figures 7.17–7.28 (variance reduction as a function of the variance ratio). The findings confirm that when opposite positions are taken, variance reduction ranges between 32.6 per cent and 89.3 per cent—the latter being the case of taking a long position on the Kuwait market and a short position on the US market.

Table 7.8: Effective Diversification with Short Position on the GCC Markets against Foreign Markets

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	USA	0.0001005	0.0000546	1.8406593	0.4567164
KUW	UK	0.0001005	0.0000717	1.4023521	0.2869123
KUW	JAP	0.0001005	0.0000780	1.2896855	0.2246172
Panel B					
KSA	USA	0.0000735	0.0000396	1.8556975	0.4611191
KSA	UK	0.0000735	0.0000531	1.3839100	0.2774097
KSA	JAP	0.0000735	0.0000545	1.3483600	0.2583583
Panel C					
BAH	USA	0.000121	0.0001057	1.1455479	0.1270553
BAH	UK	0.000121	0.0000974	1.2428001	0.1953654
BAH	JAP	0.000121	0.0001002	1.2073823	0.1717619
Panel D					
OMN	USA	0.0000406	0.0000219	1.8513966	0.4598672
OMN	UK	0.0000406	0.0000267	1.5205993	0.3423645
OMN	JAP	0.0000406	0.0000328	1.2388217	0.1927813
Panel E					
QAR	USA	0.0000852	0.00004489	1.8979728	0.4731220
QAR	UK	0.0000852	0.0000581	1.4664372	0.3180751
QAR	JAP	0.0000852	0.0000561	1.5187166	0.3415492
Panel F					
UAE	USA	0.0000775	0.0000479	1.6179541	0.3819354
UAE	UK	0.0000775	0.0000538	1.4405205	0.3058064
UAE	JAP	0.0000775	0.0000495	1.5125196	0.3612005

Table 7.9: Effective Diversification with Long Position on the GCC Markets against Foreign Markets

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	USA	0.0001005	0.0000108	9.3198874	0.8927026
KUW	UK	0.0001005	0.0000158	6.3442736	0.8423775
KUW	JAP	0.0001005	0.0000290	3.4694428	0.7117693
Panel B					
KSA	USA	0.0000735	0.0000395	1.8598173	0.4623128
KSA	UK	0.0000735	0.0000232	3.1700686	0.6845494
KSA	JAP	0.0000735	0.0000272	2.7014521	0.6298287
Panel C					
BAH	USA	0.0001210	0.0000298	4.0639522	0.7539341
BAH	UK	0.0001210	0.0000219	5.5344788	0.8193145
BAH	JAP	0.0001210	0.0000210	5.7602467	0.8263963
Panel D					
OMN	USA	0.0000406	0.0000042	9.6925215	0.8968277
OMN	UK	0.0000406	0.0000055	7.4055865	0.8649668
OMN	JAP	0.0000406	0.0000147	2.7529371	0.6367516
Panel E					
QAR	USA	0.0000852	0.0000447	1.9060403	0.4753521
QAR	UK	0.0000852	0.0000381	2.2362201	0.5528171
QAR	JAP	0.0000852	0.000022	3.8727273	0.7417840
Panel F					
UAE	USA	0.0000775	0.0000145	5.3448276	0.81290323
UAE	UK	0.0000775	0.0000259	2.9922779	0.66580645
UAE	JAP	0.0000775	0.0000124	6.2493157	0.83998251

Figure 7.15: Variance Ratio against the 5% Critical Value—Kuwait against Foreign Countries (US, UK and Japan)

(a) Similar Positions (b) Opposite Positions

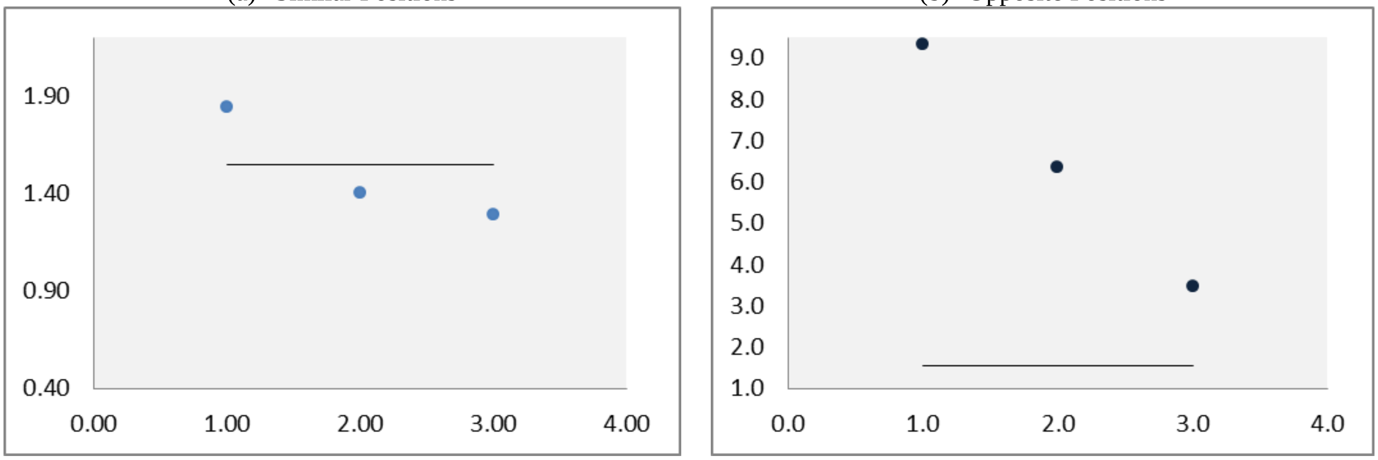


Figure 7.16: Variance Reduction as a Function of the Variance Ratio—Kuwait against Foreign Countries (US, UK and Japan)

(a) Similar Positions (b) Opposite Positions

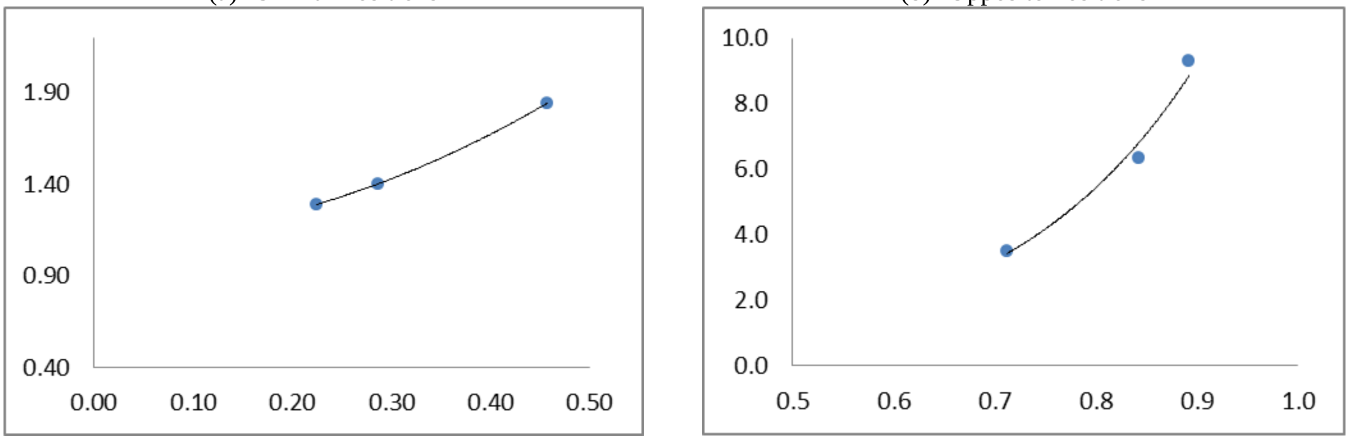


Figure 7.17: Variance Ratio against the 5% Critical Value—KSA against Foreign Countries (US, UK and Japan)

(a) Similar Position (b) Opposite Position

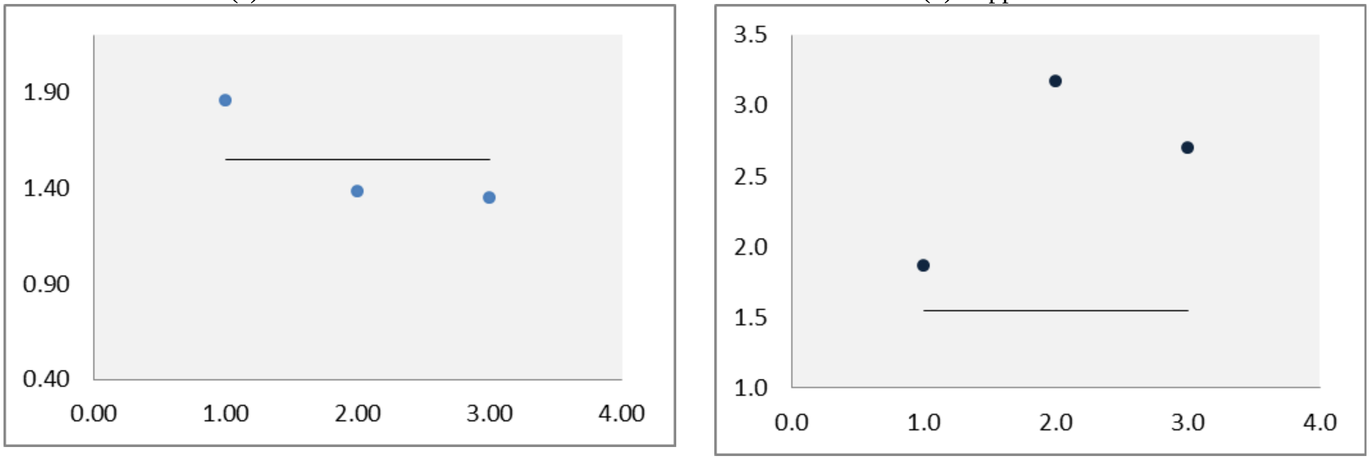
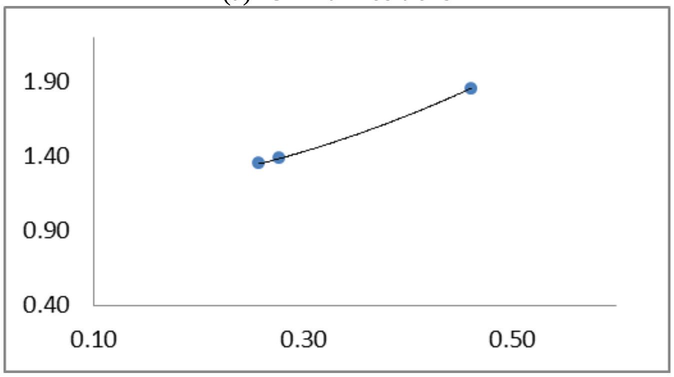


Figure 7.18: Variance Reduction as a Function of the Variance Ratio—KSA against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

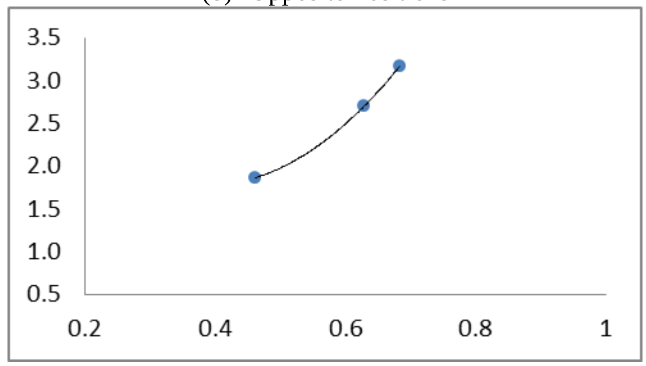
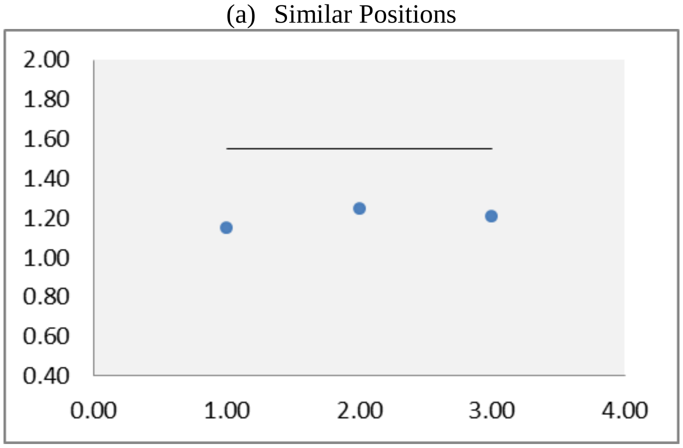


Figure 7.19: Variance Ratio against the 5% Critical Value)—Bahrain against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

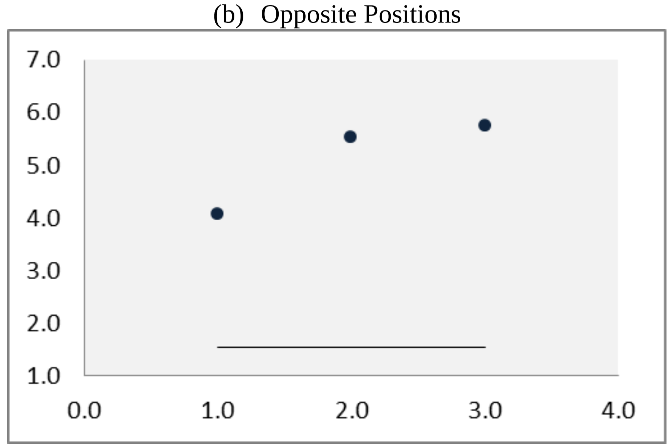
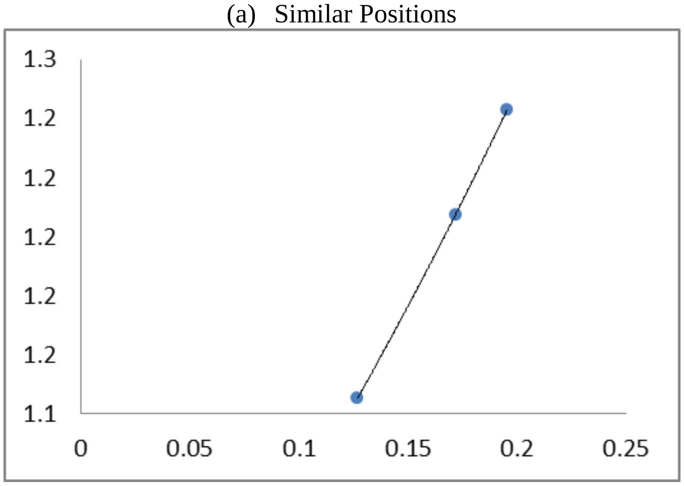


Figure 7.20: Variance Reduction as a Function of the Variance Ratio—Bahrain against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

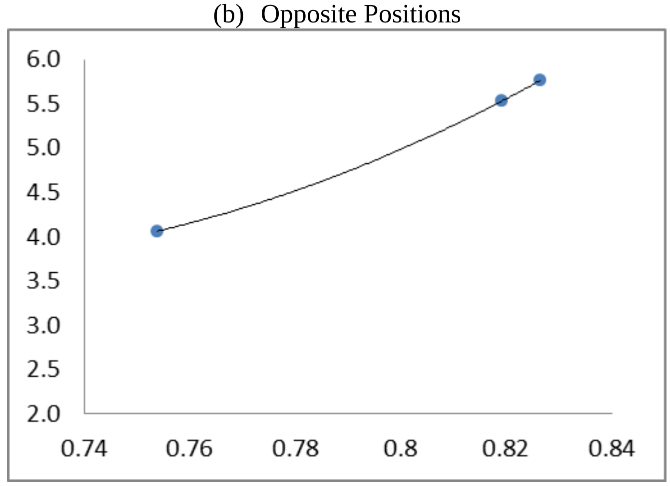
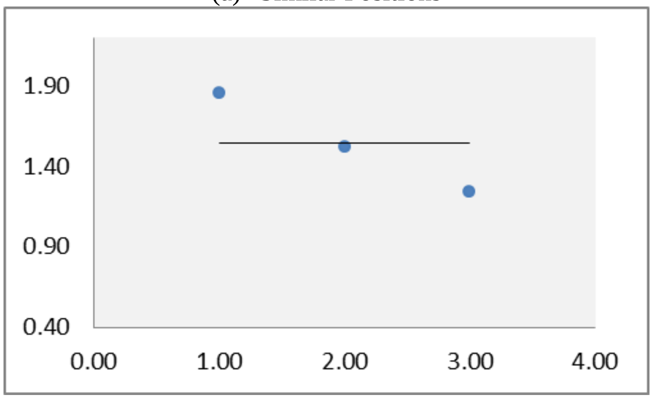


Figure 7.21: Variance Ratio against the 5% Critical Value)—Oman against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

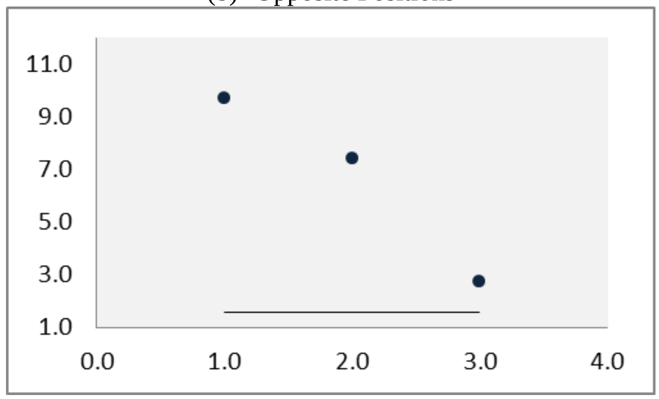
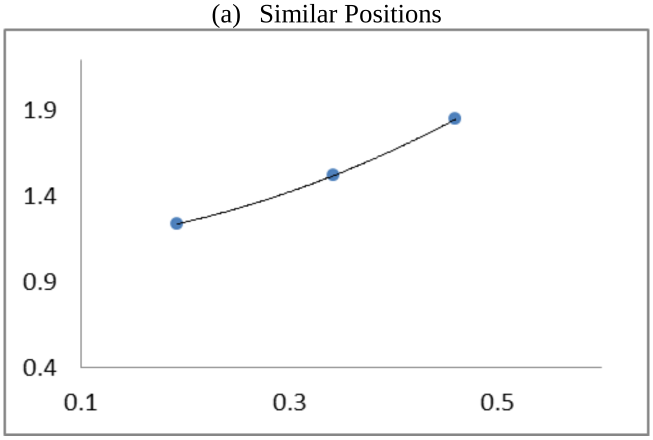


Figure 7.22: Variance Reduction as a Function of the Variance Ratio—Oman Perspective against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

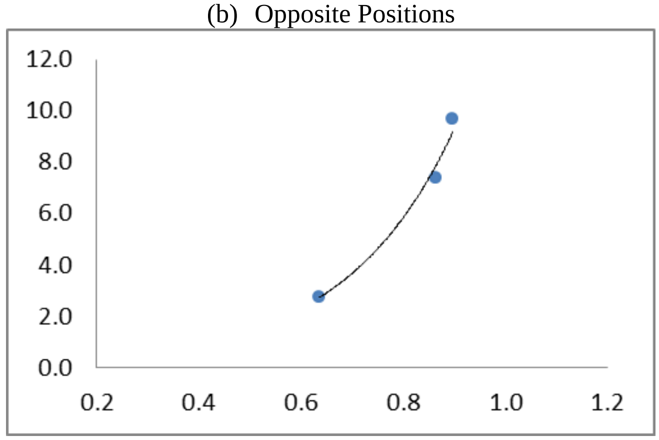
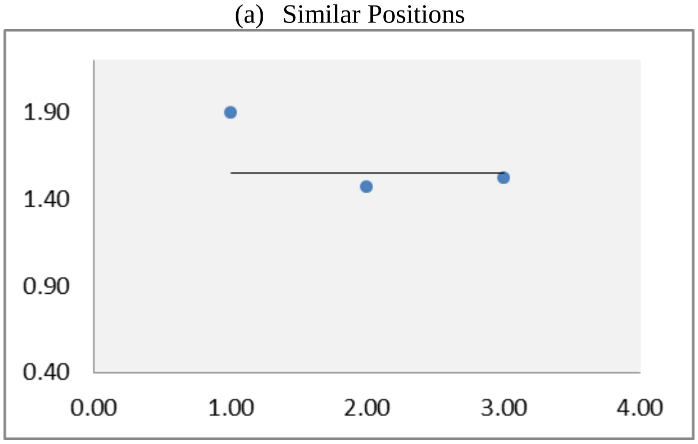


Figure 7.23: Variance Ratio against the 5% Critical Value—Qatar Perspective against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

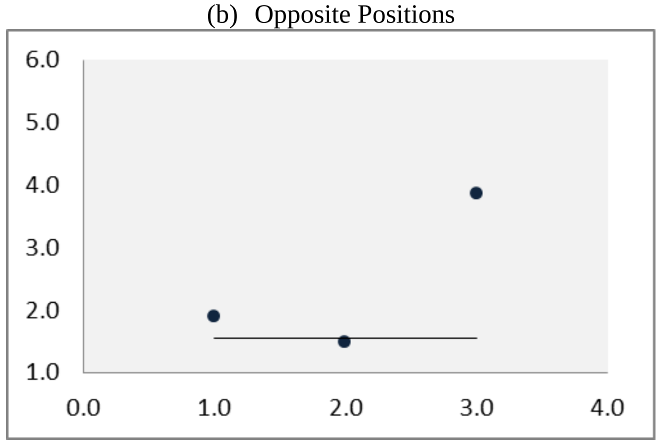
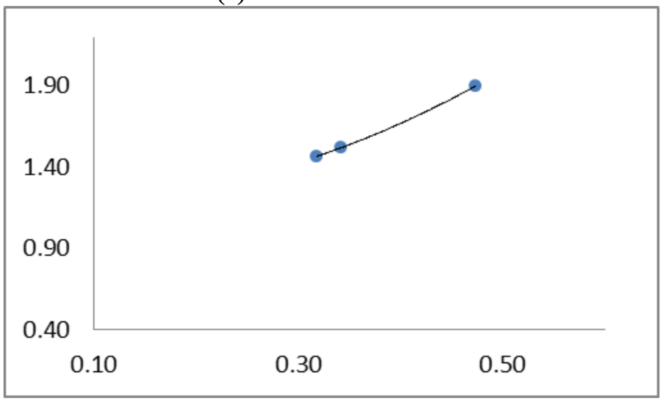


Figure 7.24: Variance Reduction as a Function of the Variance Ratio—Qatar Perspective against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

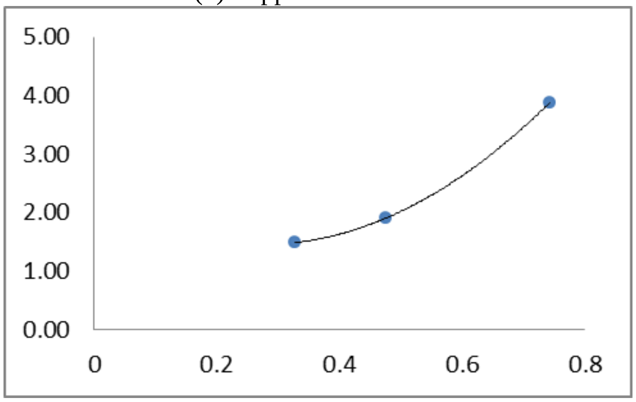
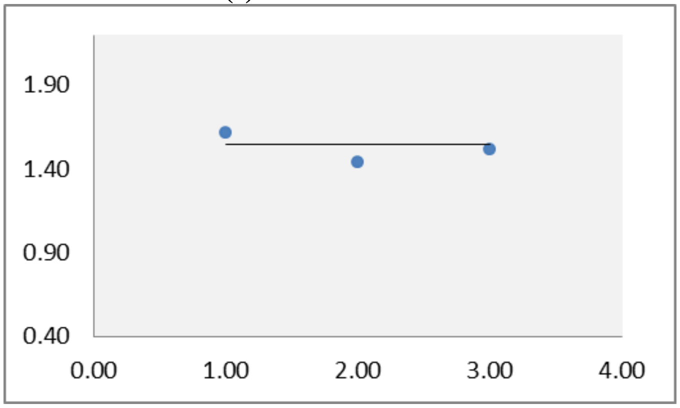


Figure 7.25: Variance Ratio against the 5% Critical Value—UAE against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions

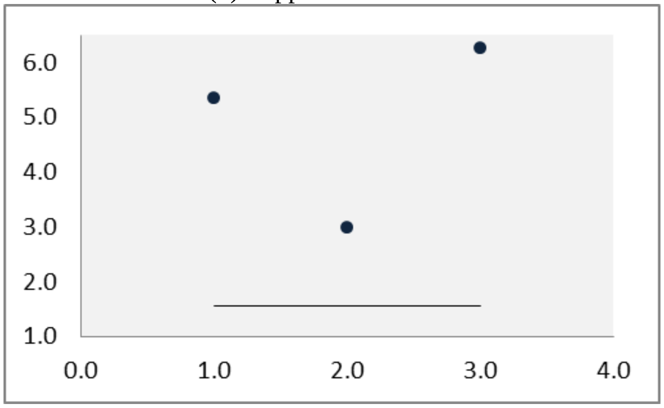
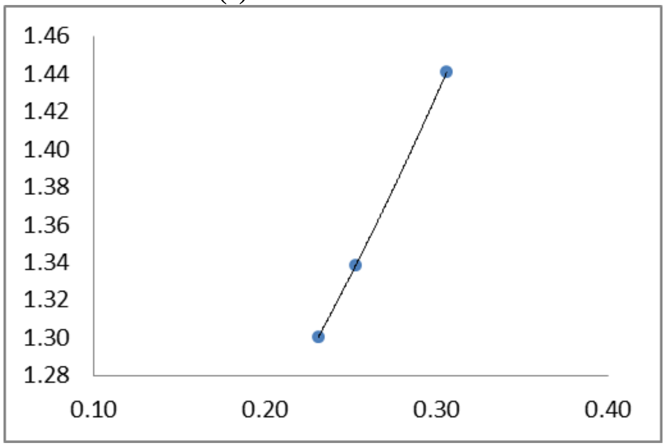
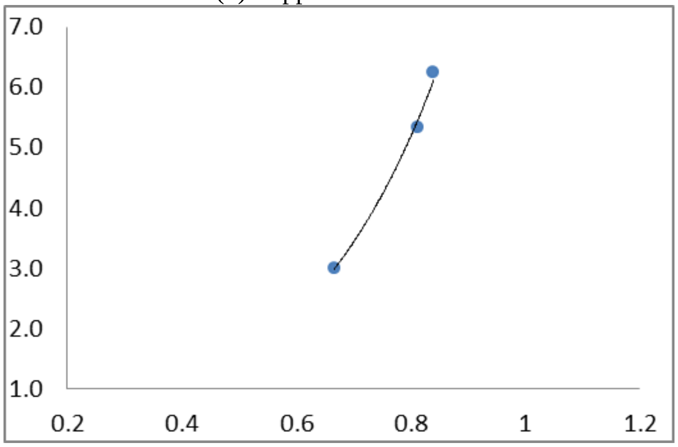


Figure7.26: Variance Reduction as a Function of the Variance Ratio—UAE against Foreign Countries (US, UK and Japan)

(a) Similar Positions



(b) Opposite Positions



Chapter 8: International Diversification with the Exchange Rate Factor

8.1 Introduction

Chapter 7 examined the benefits of international diversification without due consideration given to the effect of the exchange rate factor, as returns were measured in local currency terms. However, the foreign exchange factor cannot be ignored if foreign stock positions cannot be hedged in the forward or futures foreign exchange markets, and if these positions cannot be funded in the same currency. Given that exchange rates are predominantly flexible, the foreign exchange risk arising from volatile exchange rates cannot be ignored. In this chapter, the data and methodology described in Chapter 7 are used to examine the benefits of international diversification with the exchange rate factor.

8.2 Models

The rate of return on a domestic or stock portfolio can be measured in foreign currency terms as follows:

$$R_{f*} = \left(1 + R_f\right)(1 + e) - 1 \tag{8.1}$$

where e is the percentage change in the exchange rate measured as the domestic currency price of one unit of the foreign currency. As $R_f e \approx 0$, it is valid to approximate Equation (8.1) for small values of R_f and e, as follows:

$$R_{f*} = R_f + e \tag{8.2}$$

As such, the variance of the rate of return on the foreign portfolio, σ_{f*}^2, can be written as:

$$\sigma_{f*}^2 = \sigma_f^2 + \sigma_e^3 + 2\rho_{f,e}\sigma_f\sigma_e \tag{8.3}$$

where σ_e^2 is the variance of the percentage change in the exchange rate, $\rho_{f,e}$ is the correlation coefficient between the rate of return on the foreign market and the percentage change in the exchange rate, and σ_e is the standard deviation of the percentage change in the exchange rate. Again, the minimum value of σ_{f*}^2 is obtained when $\sigma_{f,e} = -1$. Therefore, when similar positions are taken, the variance of the rate of return can be represented as:

$$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2\sigma_{f*}^2 + 2h(1-h)\rho_{d,f*}\sigma_d\sigma_{f*} \tag{8.4}$$

By substituting Equation (8.3) into Equation (8.4), we obtain:

$$\sigma_p^2 = h^2\sigma_d^2 + (1-h)^2\left[\sigma_f^2 + \sigma_e^2 + 2\rho_{f,e}\sigma_f\sigma_e\right] + 2h(1-h)\rho_{d,f*}\sigma_d\sigma_{f*} \tag{8.5}$$

Equation (8.5) shows that the variance of the portfolio depends on two correlation coefficients, in which case the minimum variance of the rate of return on the international portfolio is attained when $\rho_{f,e} = \rho_{d,f*} = -1$. Therefore, the variance of the rate of return on the international portfolio can be expressed in terms of $\rho_{f,e}$, since:

$$\rho_{d,f*} = \frac{\sigma_{d,f*}}{\sigma_d\sigma_{f*}} \tag{8.6}$$

This gives:

$$\rho_{d,f*} = \frac{\sigma_{d,f*}}{\sigma_d\sqrt{\sigma_f^2 + \sigma_e^2 + 2\rho_{f,e}\sigma_f\sigma_e}} \tag{8.7}$$

Hence:

$$\sigma_P^2 = h^2\sigma_d^2 + (1-h)^2\left[\sigma_f^2 + \sigma_e^2 + 2\rho_{f,e}\sigma_f\sigma_e\right] + 2h(h-1) * \left[\frac{\sigma_{d,f}\sigma_d\sigma_f}{\sigma_d\sqrt{\sigma_f^2+\sigma_e^2+2\rho_{f,e}\sigma_f\sigma_e}}\right] \tag{8.8}$$

In Equation (8.8), the effect of $\rho_{d,f}$ on σ_p^2 is ambiguous. There are contradictory interpretations of the correlation between the percentage change in the exchange rate and the foreign market rate of return.

8.3 Empirical Results

The results reported in Table 8.1 are similar to those in Table 7.3, as only a few combinations, involving only developed markets (the US, UK and Japan), produce significantly positive correlations.

Table 8.1: Correlation Matrix of the Rates of Return with the Exchange Rate Factors

	KUW	KSA	BAH	OMN	QAT	UAE	USA	UK	JAP
KUW	1	0.12	-0.35	0.13	0.16	0.12	0.08	0.09	0.02
KSA	0.12	1	0.21	0.12	0.42	0.20	0.02	0.04	-0.05
BAH	-0.35	0.21	1	-0.35	0.12	0.21	0.11	0.11	0.26
OMN	0.14	0.12	-0.35	1	0.16	0.12	0.08	0.09	0.02
QAT	0.16	0.42	0.12	0.16	1	0.42	0.12	0.15	-0.07
UAE	0.12	0.20	0.21	0.12	0.42	1	0.02	0.04	-0.05
USA	0.08	0.02	0.11	0.08	0.12	0.02	1	0.80	0.17
UK	0.09	0.04	0.11	0.09	0.15	0.04	0.80	1	0.16
JAP	0.15	0.12	-0.35	0.13	0.16	0.12	0.18	0.19	0.22

In this chapter, the exchange rate factor is taken into account by allowing any of the markets to be domestic markets. Figure 8.1 displays the variance ratio for portfolio returns. The pattern is similar to that of Tables 7.6 and 7.7. Thus, the findings are not significantly different—in this case, the exchange rate factor does not change the findings drastically, as opposed to the case when the exchange rate is not included.

When similar positions are taken, Figure 8.1 shows only four out of six portfolios resulting in effective diversification. The findings are similar to those exhibited in Figure 7.1, when the effectiveness of diversification was tested without the foreign exchange rate factor. Tables 8.2 and 8.3 show the underlying calculations of the results displayed in Figure 8.2. The findings also confirm that when opposite positions are taken, the variance reduction ranges between 76.2 and 90.4 per cent. Consequently, all of the portfolios appear above the critical horizontal line (VAR=1.687). Based on these results, it can be concluded that international diversification is only effective when opposite positions are taken.

Table 8.2: Effective Diversification with a Short Position on the Foreign Market (with the Exchange Rate Factor)

Domestic Market	Foreign Market	σ_d^2	σ_p^2	VR	VD
USA	UK	0.0000223	0.0000201	1.109453	0.098655
USA	JAP	0.0000223	0.0000217	1.027650	0.026906
UK	USA	0.0000294	0.0000163	1.803681	0.445578
UK	JAP	0.0000294	0.0000160	1.837500	0.455782
JAP	USA	0.0000578	0.0000213	2.713615	0.631488
JAP	UK	0.0000578	0.0000334	1.730539	0.422145

Table 8.3: Effective Diversification with a Long Position on the Foreign Market (with the Exchange Rate Factor)

Domestic Market	Foreign Market	σ_d^2	σ_p^2	VR	VD
USA	UK	0.0000223	0.00000490	4.551020	0.780269
USA	JAP	0.0000223	0.00000530	4.207547	0.762332
UK	USA	0.0000294	0.00000412	7.135922	0.859864
UK	JAP	0.0000294	0.00000413	7.118644	0.859524
JAP	USA	0.0000578	0.00000550	10.509091	0.904844
JAP	UK	0.0000578	0.00000860	6.720930	0.851211

Figure 8.1: Variance Ratios against the 5% Critical Value -with the Exchange Rate Factor

(a) Similar Positions (b) Opposite Positions

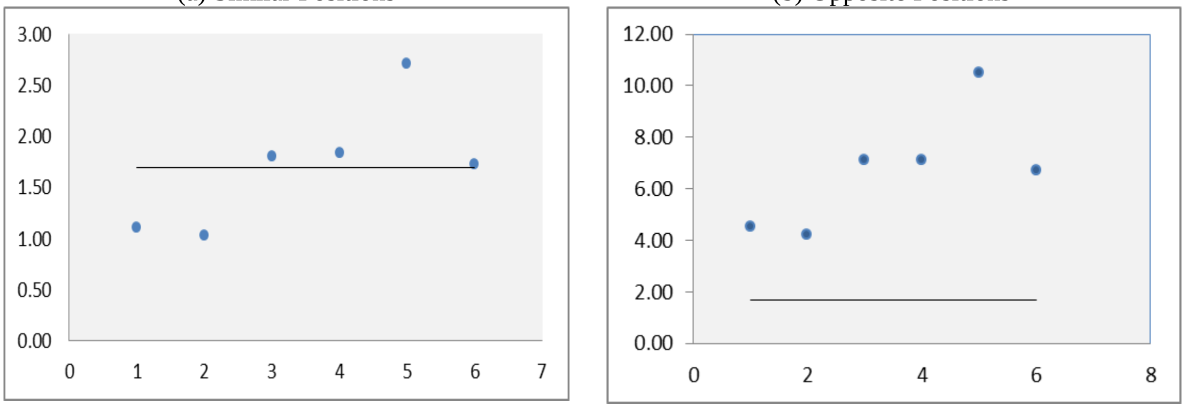
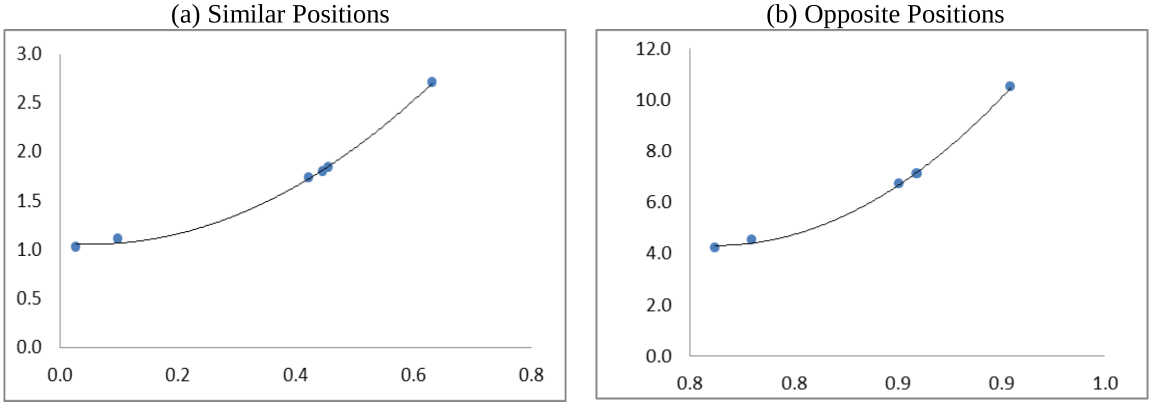


Figure 8.2: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor

(a) Similar Positions (b) Opposite Positions



Figures 8.3–8.14 shows the variance ratios for 30 portfolios, where the findings do not vary significantly, implying that the exchange rate factor does not change the findings drastically (compared with Figures 7.5–7.10). When similar positions are taken, Figures 8.3–8.14 show that seven portfolios produce effective diversification. These findings are identical to those of Figures 7.5–7.10, when effective diversification was tested without the exchange rate factor. Further, as shown in Tables 8.4 and 8.5, the percentage variance reduction (VR) ranges between 44.5 per cent and 90.6 per cent. The maximum VR, which is 90.6 per cent, is found when taking a long position on the Qatar market and a short position on the Bahrain market. As shown, effective diversification involves

emerging markets only, and only when opposite positions are taken, as all portfolios are above the horizontal critical line (VAR=1.687). The findings of the variance reduction test on the six emerging stock markets are reported in Tables 8.4 and 8.5.

As shown in Table 8.4 and Figures 8.5(a) and 8.11(a), there is an inconclusive diversification effect for two portfolios, as the variance ratio (VR) is close to the 5 per cent critical value. These portfolios are when the domestic stock market is Saudi Arabia and the foreign stock market is the UAE, and also when the domestic market is Qatar and the foreign stock market is Kuwait. Moreover, one portfolio has a VR of less than the 5 per cent critical value—that is, when Bahrain is the domestic stock market and Kuwait is the foreign market. Table 8.3 and Table 8.4 presents detailed results of the six stock markets, taking into consideration the exchange rate factor.

The findings for all six stock markets show effective diversification benefits in the GCC stock markets and when only opposite positions are taken. Thus, it can be concluded that GCC countries can provide opportunities for effective diversification for other portfolios, despite the increased level of integration.

Table 8.4: Effective Diversification with a Short Position on the Emerging Market (with Exchange Rate Factor)

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	KSA	0.0001005	0.0000720	1.395833	0.283582
KUW	BAH	0.0001005	0.0000784	1.281234	0.219502
KUW	OMN	0.0001005	0.0000343	2.930029	0.658706
KUW	QAR	0.0001005	0.0000688	1.460756	0.315423
KUW	UAE	0.0001005	0.0000473	2.124736	0.529353
Panel B					
KSA	KUW	0.0000735	0.0000454	1.618943	0.382313
KSA	BAH	0.0000735	0.0000861	1.171429	0.146341
KSA	OMN	0.0000735	0.0000335	2.194030	0.544218
KSA	QAR	0.0000735	0.0000819	1.114286	0.102564
KSA	UAE	0.0000735	0.0000440	1.670455	0.401361
Panel C					
BAH	KUW	0.0001210	0.0001114	1.086176	0.079339
BAH	KSA	0.0001210	0.0001014	1.193294	0.161983
BAH	OMN	0.0001210	0.0001032	1.172481	0.147107
BAH	QAR	0.0001210	0.0001190	1.016807	0.016529
BAH	UAE	0.0001210	0.0001188	1.018519	0.018182
Panel D					
OMN	KUW	0.0000406	0.0000318	1.276730	0.216749
OMN	KSA	0.0000406	0.0000382	1.062827	0.059113
OMN	BAH	0.0000406	0.0000253	1.604743	0.376847
OMN	QAR	0.0000406	0.0000260	1.561538	0.359606
OMN	UAE	0.0000406	0.0000288	1.409722	0.290640
Panel E					
QAR	KUW	0.0000852	0.00005171	1.647650	0.393075
QAR	KSA	0.0000852	0.00006500	1.310769	0.237089
QAR	BAH	0.0000852	0.00003200	2.662500	0.624413
QAR	OMN	0.0000852	0.00004760	1.789916	0.441315
QAR	UAE	0.0000852	0.00004491	1.897128	0.472887
Panel F					
UAE	KUW	0.0000775	0.00004420	1.753394	0.429677
UAE	KSA	0.0000775	0.00003960	1.957071	0.489032
UAE	BAH	0.0000775	0.00006290	1.232114	0.188387
UAE	OMN	0.0000775	0.00006950	1.115108	0.103226
UAE	QAR	0.0000775	0.00003717	2.085015	0.520387

Table 8.5: Effective Diversification with a Long Position on the Emerging Market (with Exchange Rate Factor)

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	KSA	0.0001005	0.0000341	2.947214	0.660697
KUW	BAH	0.0001005	0.0000541	1.857671	0.461692
KUW	OMN	0.0001005	0.0000177	5.677966	0.823881
KUW	QAR	0.0001005	0.0000329	3.054711	0.672637
KUW	UAE	0.0001005	0.0000243	4.135802	0.758209
Panel B					
KSA	KUW	0.0000735	0.0000781	1.5512821	0.355372
KSA	BAH	0.0000735	0.0000208	3.533654	0.717007
KSA	OMN	0.0000735	0.0000236	3.114407	0.678912
KSA	QAR	0.0000735	0.0000361	2.036011	0.508844
KSA	UAE	0.0000735	0.0000494	1.487854	0.327891
Panel C					
BAH	KUW	0.0001210	0.0000672	1.800595	0.444628
BAH	KSA	0.0001210	0.0000251	4.820717	0.792562
BAH	OMN	0.0001210	0.0000262	4.618321	0.783471
BAH	QAR	0.0001210	0.0000265	4.566038	0.780992
BAH	UAE	0.0001210	0.0000282	4.290788	0.766942
Panel D					
OMN	KUW	0.0000406	0.0000121	3.355372	0.701971
OMN	KSA	0.0000406	0.00000955	4.251309	0.764778
OMN	BAH	0.0000406	0.0000163	2.490798	0.598522
OMN	QAR	0.0000406	0.0000156	2.602564	0.615764
OMN	UAE	0.0000406	0.0000074	5.63016	0.822385
Panel E					
QAR	KUW	0.0000852	0.0000123	6.926829	0.855634
QAR	KSA	0.0000852	0.000016	5.325000	0.812207
QAR	BAH	0.0000852	0.000008	10.650000	0.906103
QAR	OMN	0.0000852	0.0000122	6.983607	0.856808
QAR	UAE	0.0000852	0.0000111	7.675676	0.869718
Panel F					
UAE	KUW	0.0000775	0.0000112	6.919643	0.855484
UAE	KSA	0.0000775	0.0000321	2.421875	0.587097
UAE	BAH	0.0000775	0.0000158	4.905063	0.796129
UAE	OMN	0.0000775	0.0000174	4.454023	0.775484
UAE	QAR	0.0000775	0.0000394	1.967005	0.491613

Figure 8.3: Variance Ratio against the 5% Critical Value with the Exchange Rate Factor—Kuwait

(a) Similar Positions (b) Opposite Positions

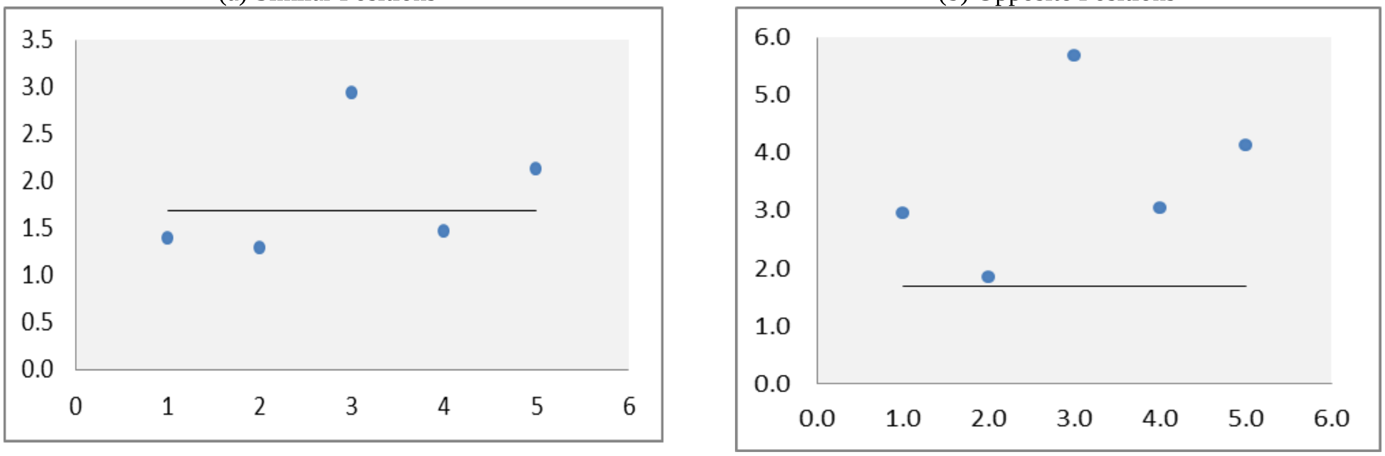


Figure 8.4: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor—Kuwait

(a) Similar Positions (b) Opposite Positions

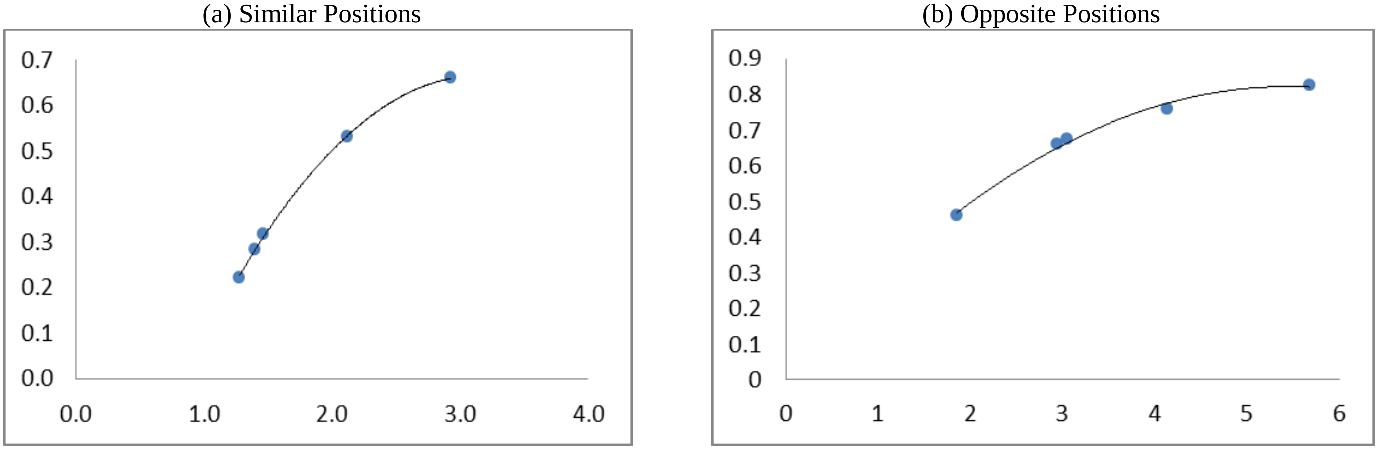


Figure 8.5: Variance Ratio against the 5% Critical Value with the Exchange Rate Factor—Saudi Arabia

(a) Similar Positions (b) Opposite Positions

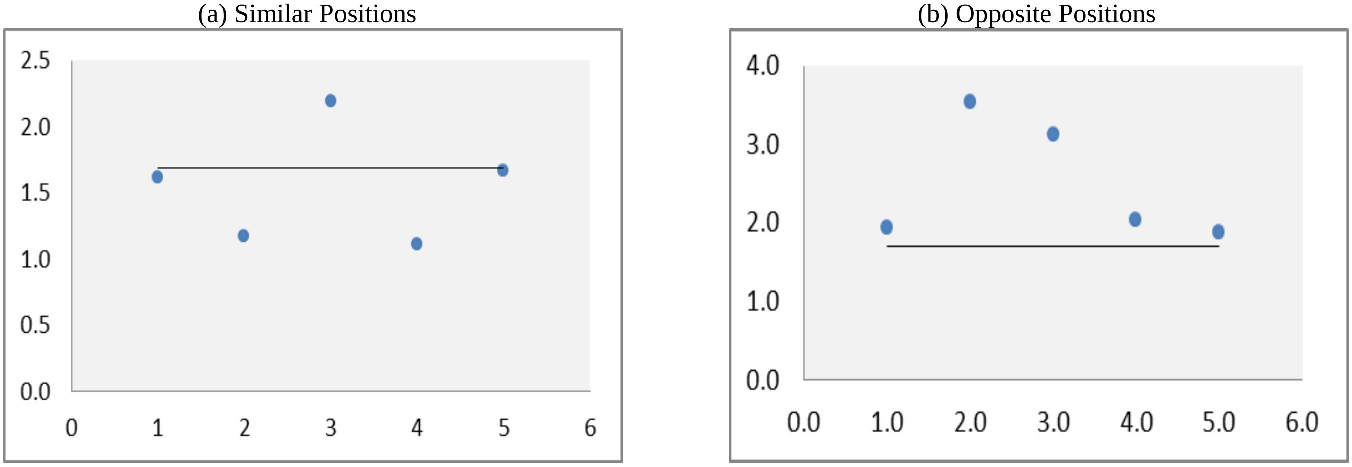


Figure 8.6: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor—Saudi Arabia

(a) Similar Positions (b) Opposite Positions

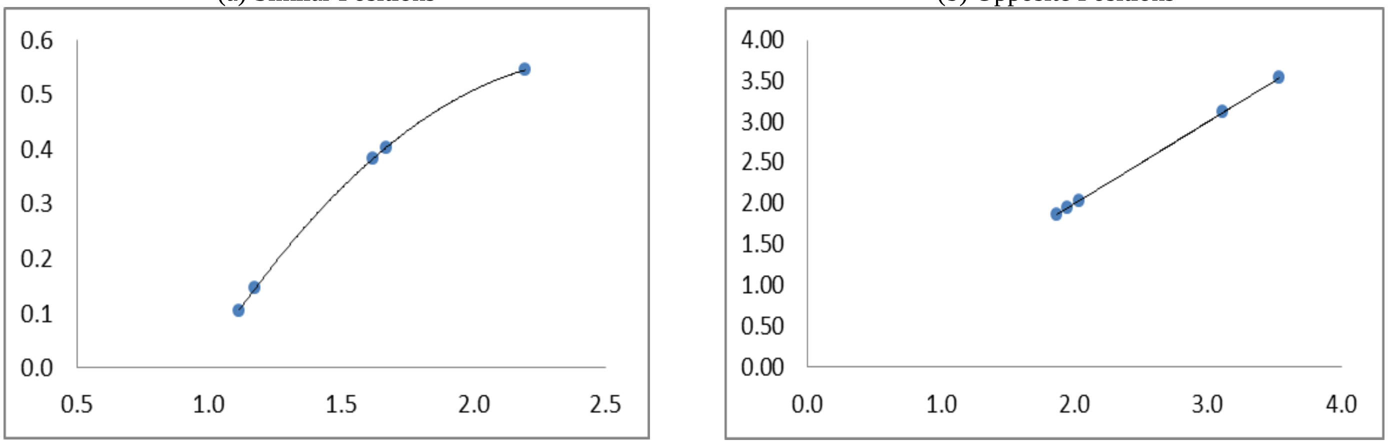


Figure 8.7: Variance Ratio against the 5% Critical Value with the Exchange Rate Factor—Bahrain

(a) Similar Positions (b) Opposite Positions

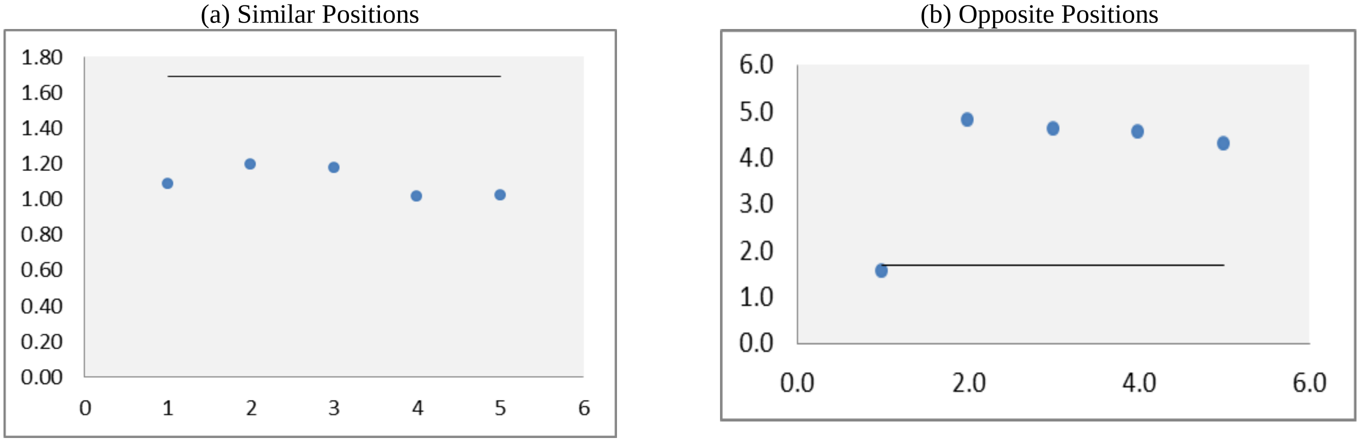


Figure 8.8: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor—Bahrain

(a) Similar Positions (b) Opposite Positions

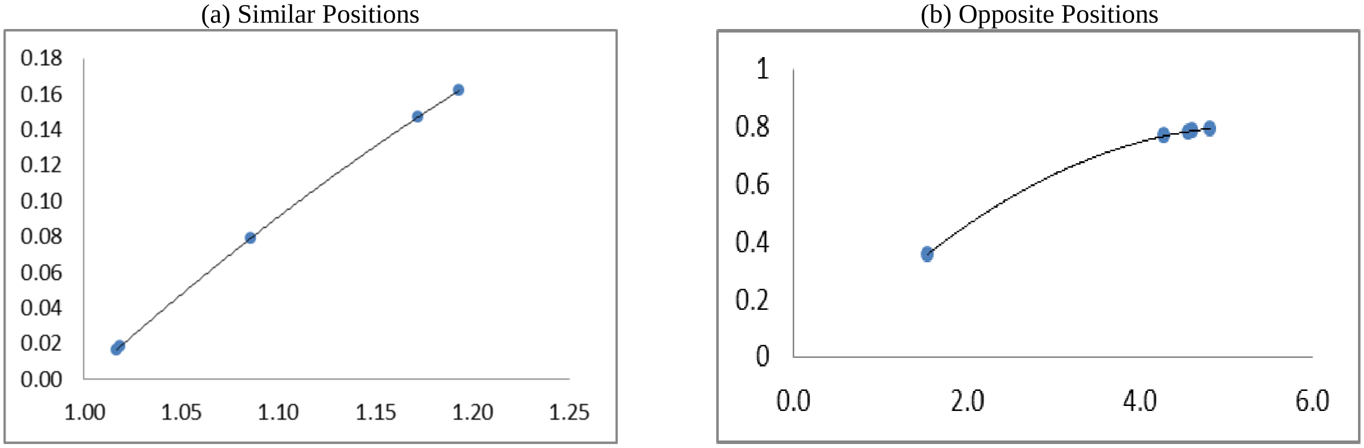


Figure 8.9: Variance Ratio against the 5% Critical Value with the Exchange Rate Factor—Oman

(a) Similar Positions (b) Opposite Positions

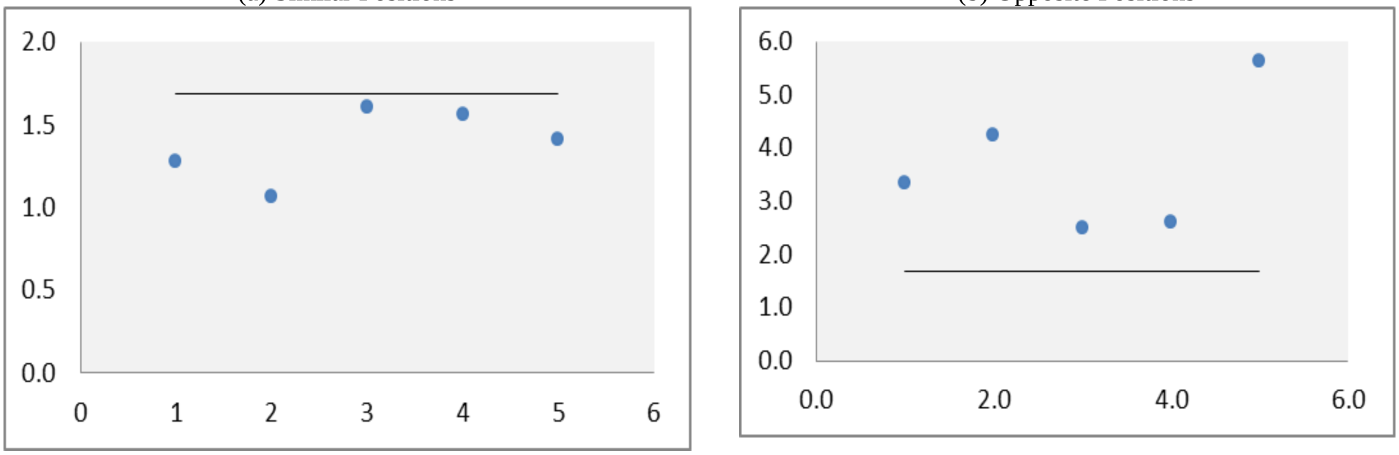


Figure 8.10: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor—Oman

(a) Similar Positions (b) Opposite Positions

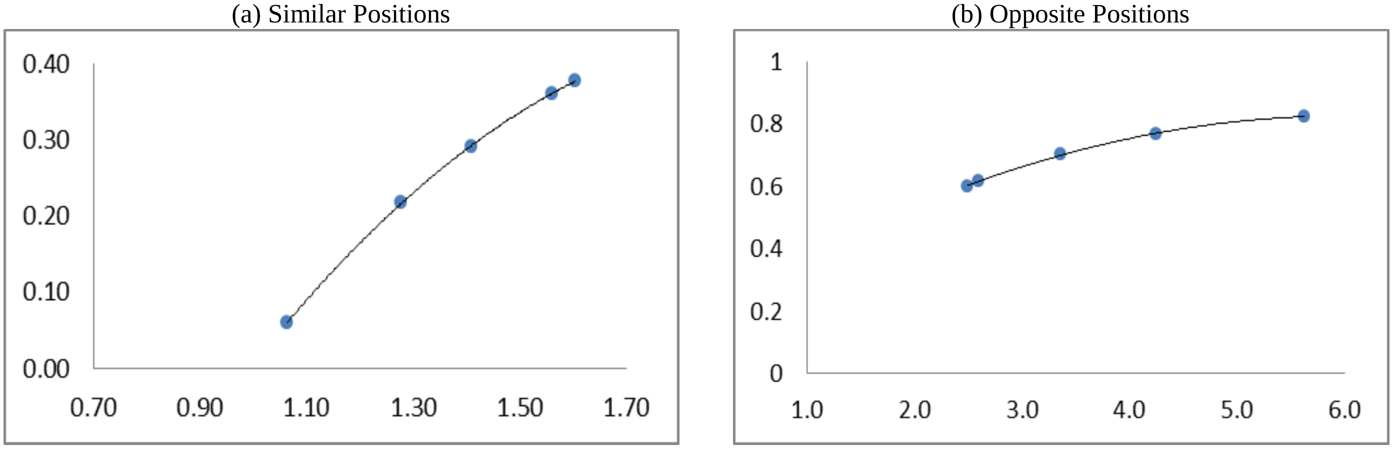


Figure 8.11: Variance Ratio against the 5% Critical Value with Exchange Rate Factor—Qatar

(a) Similar Positions (b) Opposite Positions

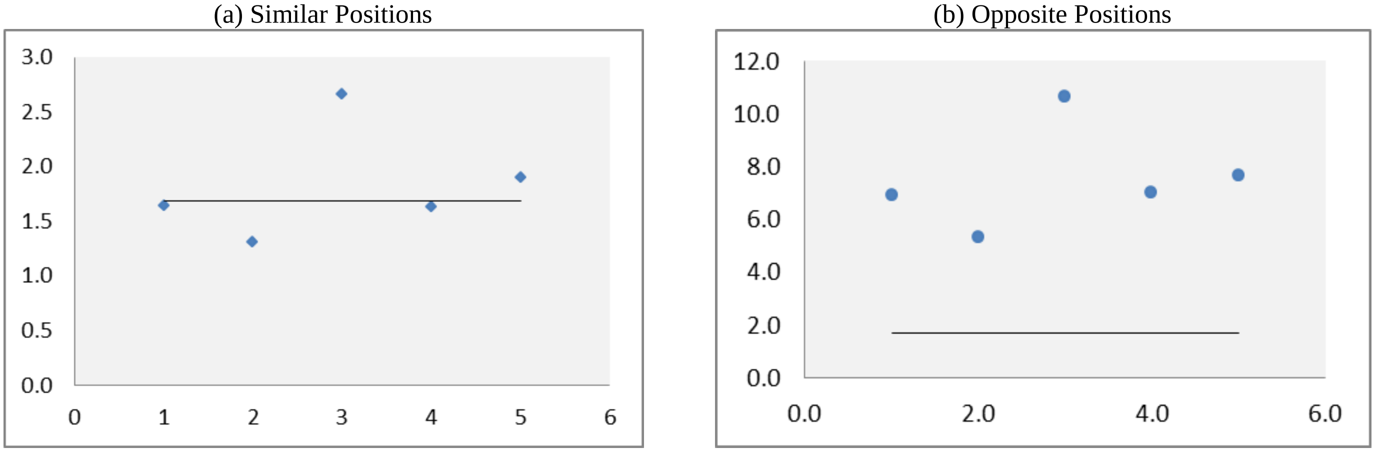
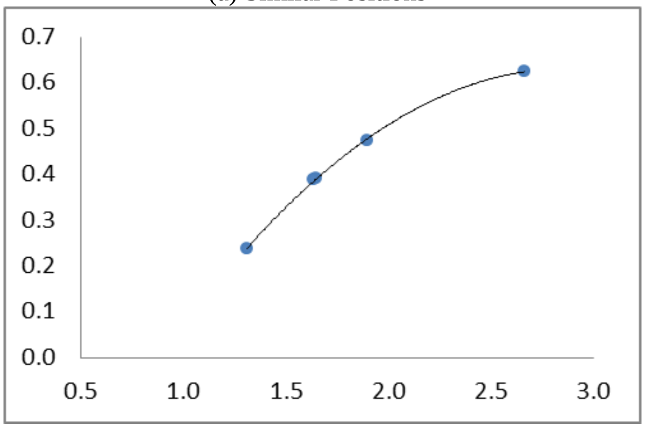


Figure 8.12: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor—Qatar

(a) Similar Positions



(b) Opposite Positions

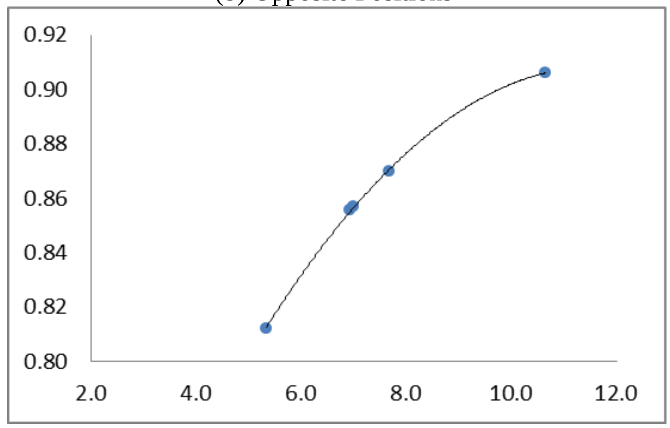
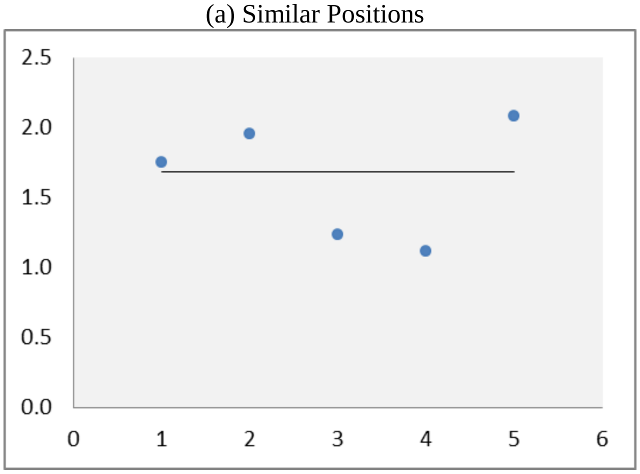


Figure 8.13: Variance Ratio against the 5% Critical Value with the Exchange Rate Factor—UAE

(a) Similar Positions



(b) Opposite Positions

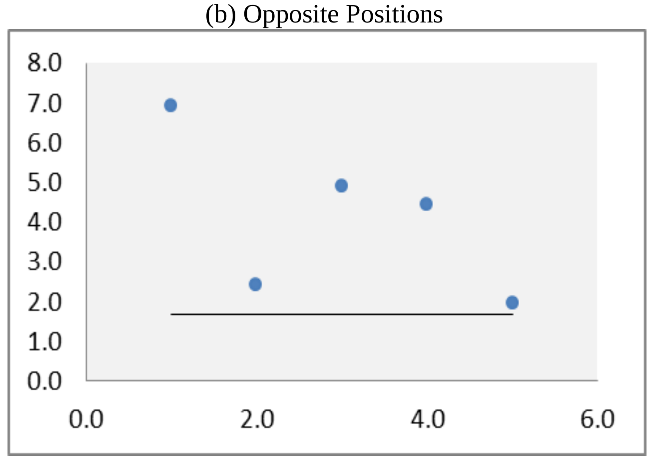
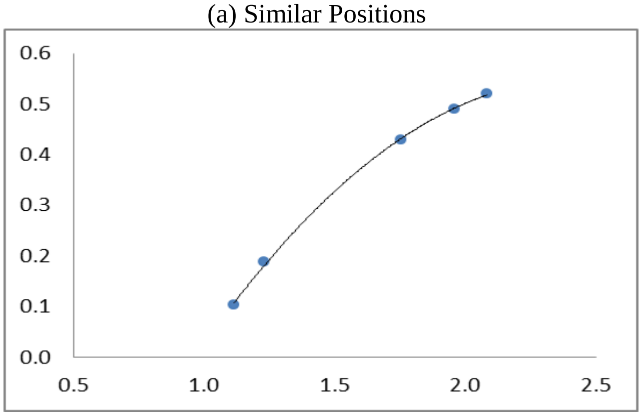
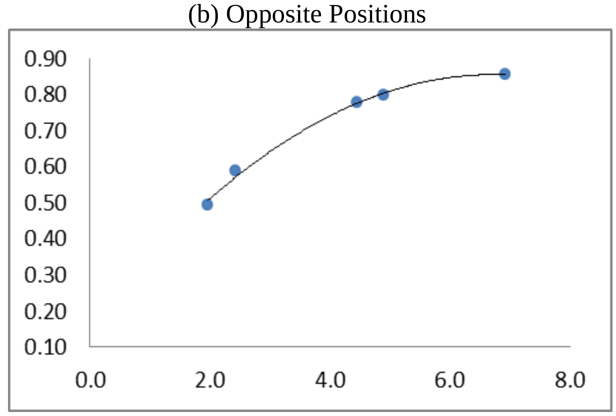


Figure 8.14: Variance Reduction as a Function of the Variance Ratio with the Exchange Rate Factor—UAE

(a) Similar Positions



(b) Opposite Positions



When the emerging countries are the domestic markets and developed countries (US, UK and Japan) are foreign markets, and taking the exchange rate factor into account, the portfolio returns are measures in domestic currency terms. Figures 8.15–8.22 show the variance ratios for the 18 portfolios. The findings do not vary significantly, implying that the exchange rate factor does not change the findings drastically, as opposed to the situation when the exchange rate factor is not taken into account. When similar positions are taken, Figures 8.15–8.22 show that four out of six portfolios produce effective diversification. These findings are identical to those reported by Figures 7.17–7.28, when the effectiveness of diversification was tested without including the foreign exchange rate factor. The variance reduction (VD) calculations are shown in Tables 8.6 and 8.7, where it ranges between 46.8 per cent and 89.4 per cent. When opposite positions are taken, all portfolios fall above the critical horizontal line (VR=1.687), implying effective diversification.

Table 8.6: Effective Diversification with Short Positions on the GCC Markets against Foreign Markets (with the Exchange Rate Factor)

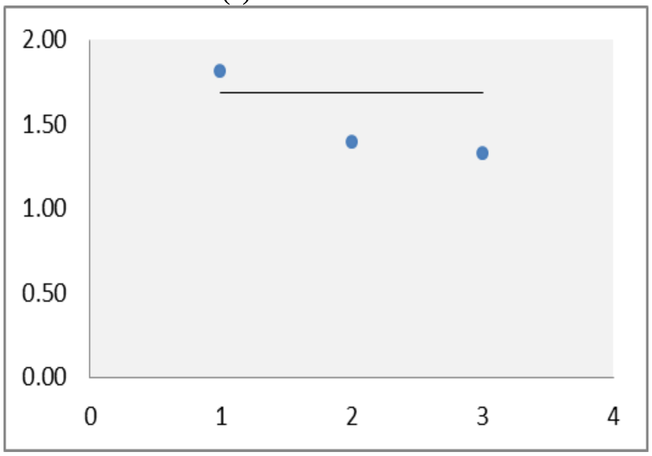
Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	USA	0.0001005	0.0000554	1.814079	0.448756
KUW	UK	0.0001005	0.0000720	1.395833	0.283582
KUW	JAP	0.0001005	0.0000760	1.322368	0.243781
Panel B					
KSA	USA	0.0000735	0.0000401	1.832918	0.454422
KSA	UK	0.0000735	0.0000534	1.376404	0.273469
KSA	JAP	0.0000735	0.0000535	1.373832	0.272109
Panel C					
BAH	USA	0.000121	0.0001061	1.140434	0.123140
BAH	UK	0.000121	0.0000971	1.246138	0.197521
BAH	JAP	0.000121	0.00010025	1.206983	0.171488
Panel D					
OMN	USA	0.0000406	0.0000221	1.837104	0.455665
OMN	UK	0.0000406	0.0000268	1.514925	0.339901
OMN	JAP	0.0000406	0.0000328	1.237805	0.192118
Panel E					
QAR	USA	0.0000852	0.0000449	1.897550	0.473005
QAR	UK	0.0000852	0.0000584	1.458904	0.314554
QAR	JAP	0.0000852	0.0000562	1.516014	0.340376
Panel F					
UAE	USA	0.0000775	0.0000481	1.611227	0.379355
UAE	UK	0.0000775	0.0000539	1.437848	0.304516
UAE	JAP	0.0000775	0.0000492	1.575203	0.365161

Table 8.7: Effective Diversification with Long Positions on the GCC Markets against Foreign Markets (with the exchange rate factor)

Domestic Markets	Foreign Markets	σ_d^2	σ_p^2	VR	VD
Panel A					
KUW	USA	0.0001005	0.0000108	9.305556	0.892537
KUW	UK	0.0001005	0.0000156	6.442308	0.844776
KUW	JAP	0.0001005	0.0000292	3.441781	0.709453
Panel B					
KSA	USA	0.0000735	0.0000391	1.879795	0.468027
KSA	UK	0.0000735	0.0000233	3.154506	0.682993
KSA	JAP	0.0000735	0.0000274	2.682482	0.627211
Panel C					
BAH	USA	0.0001210	0.0000299	4.046823	0.752893
BAH	UK	0.0001210	0.0000222	5.450450	0.816529
BAH	JAP	0.0001210	0.0000221	5.475113	0.817355
Panel D					
OMN	USA	0.0000406	0.0000043	9.441860	0.894089
OMN	UK	0.0000406	0.0000060	6.766667	0.852217
OMN	JAP	0.0000406	0.0000151	2.688742	0.628079
Panel E					
QAR	USA	0.0000852	0.0000440	1.936364	0.483568
QAR	UK	0.0000852	0.0000376	2.265957	0.558685
QAR	JAP	0.0000852	0.0000221	3.855204	0.740610
Panel F					
UAE	USA	0.0000775	0.0000144	5.381944	0.814194
UAE	UK	0.0000775	0.0000260	2.980769	0.664516
UAE	JAP	0.0000775	0.0000123	6.300813	0.841290

Figure 8.15: Variance Ratio against the 5% Critical Value (with the exchange rate factor)—Kuwait

(a) Similar Positions



(b) Opposite Positions

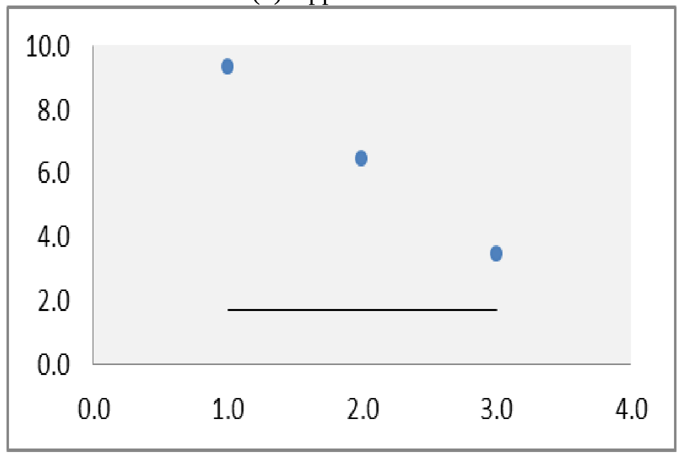
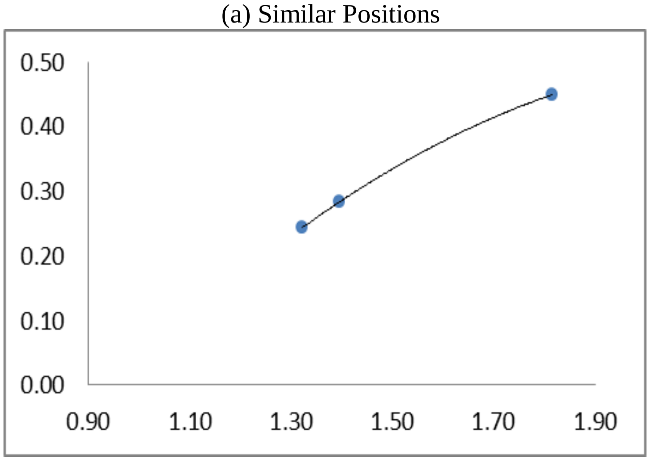


Figure 8.16: Variance Reduction as a Function of the Variance Ratio (with the exchange rate factor)—Kuwait

(a) Similar Positions



(b) Opposite Positions

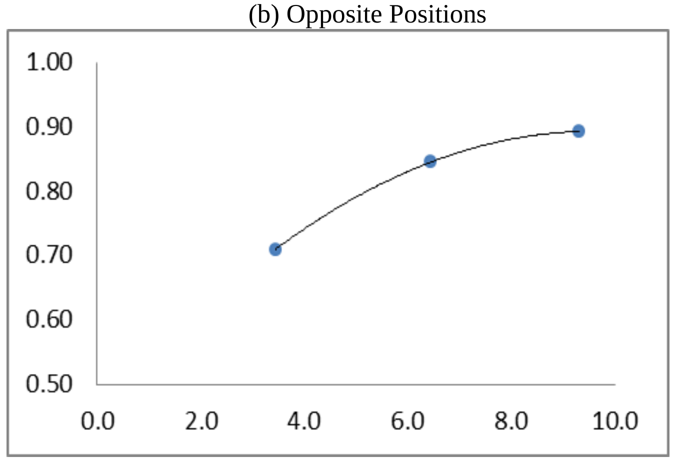
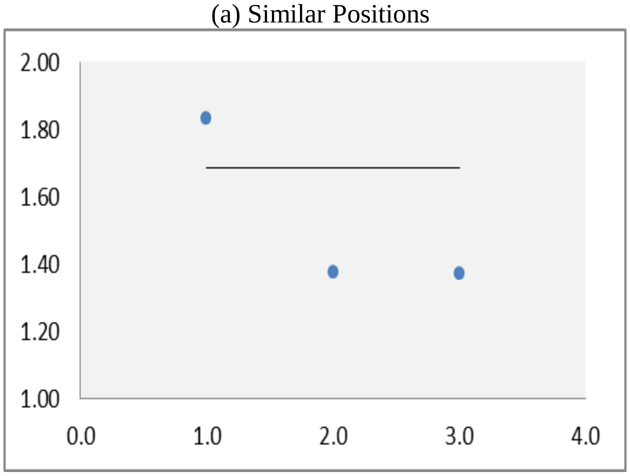


Figure 8.17: Variance Ratio against the 5% Critical Value (with the exchange rate factor)—Saudi Arabia

(a) Similar Positions



(b) Opposite Positions

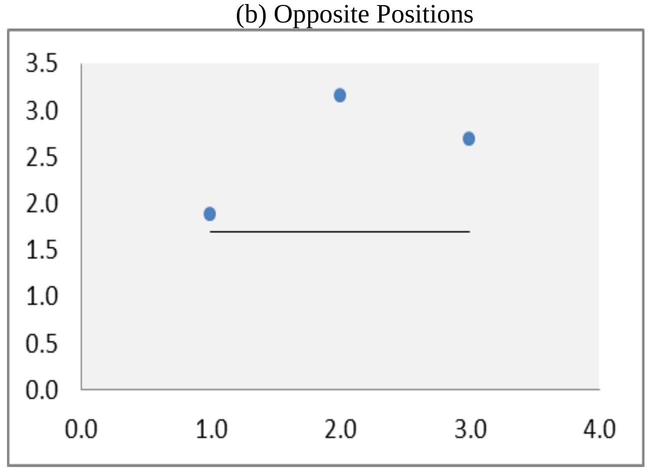
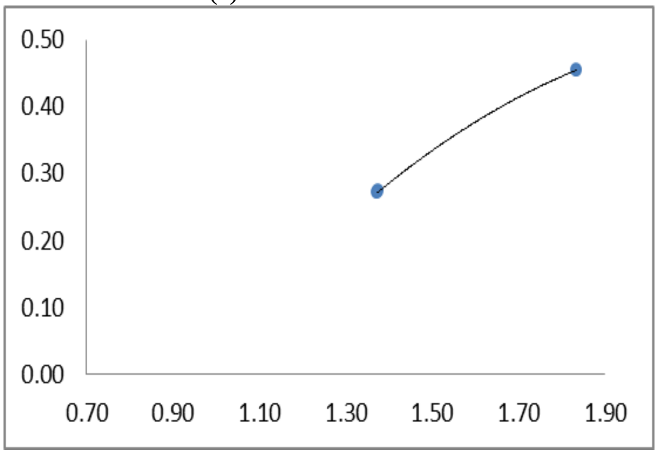


Figure 8.18: Variance Reduction as a Function of the Variance Ratio(with the exchange rate factor)—Saudi Arabia

(a) Similar Positions



(b) Opposite Positions

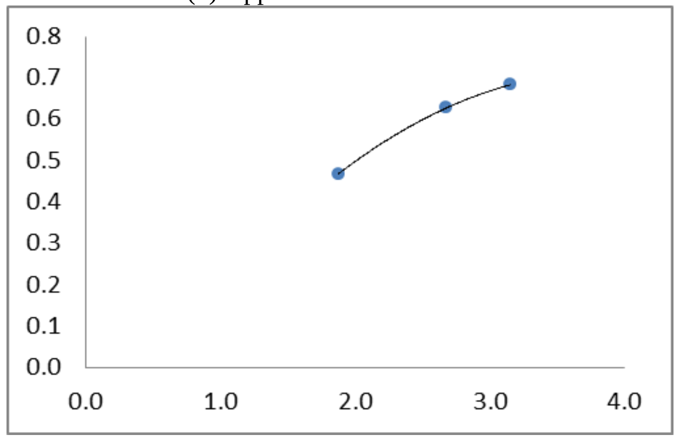
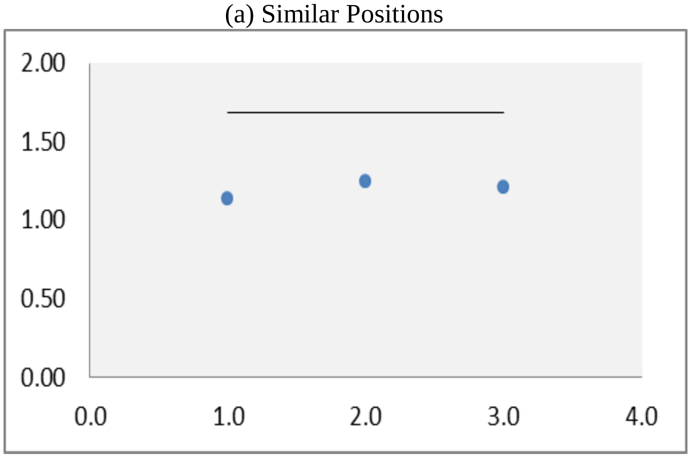


Figure 8.19: Variance Ratio against the 5% Critical Value (with the exchange rate factor)—Bahrain

(a) Similar Positions



(b) Opposite Positions

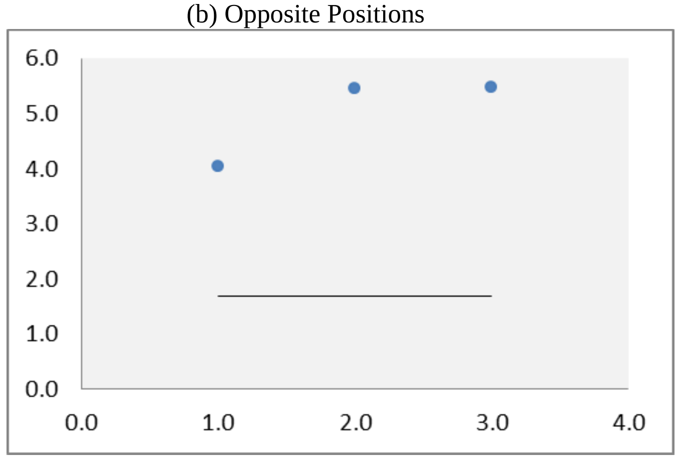
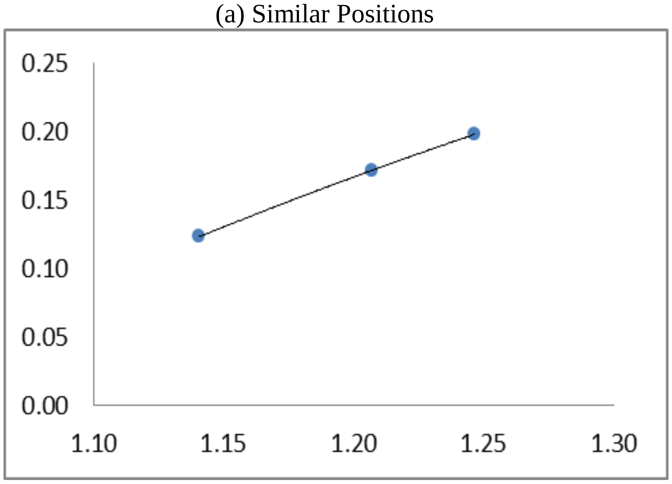


Figure 8.20: Variance Reduction as a Function of the Variance Ratio (with the exchange rate factor)—Bahrain

(a) Similar Positions



(b) Opposite Positions

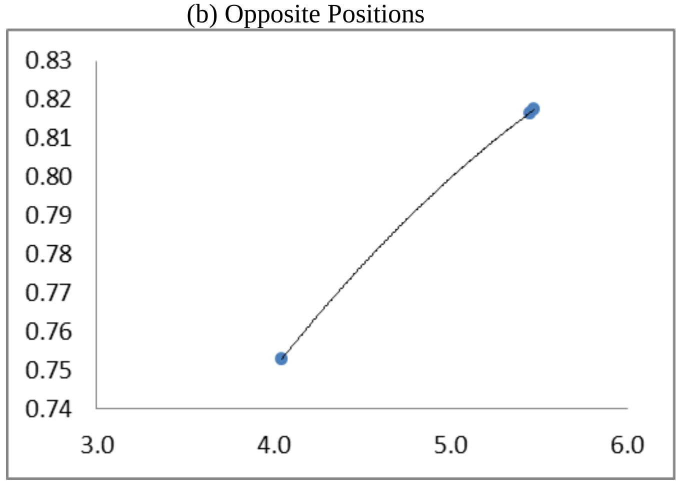


Figure 8.21: Variance Ratio against the 5% Critical Value (with the exchange rate factor)—Oman

(a) Similar Positions (b) Opposite Positions

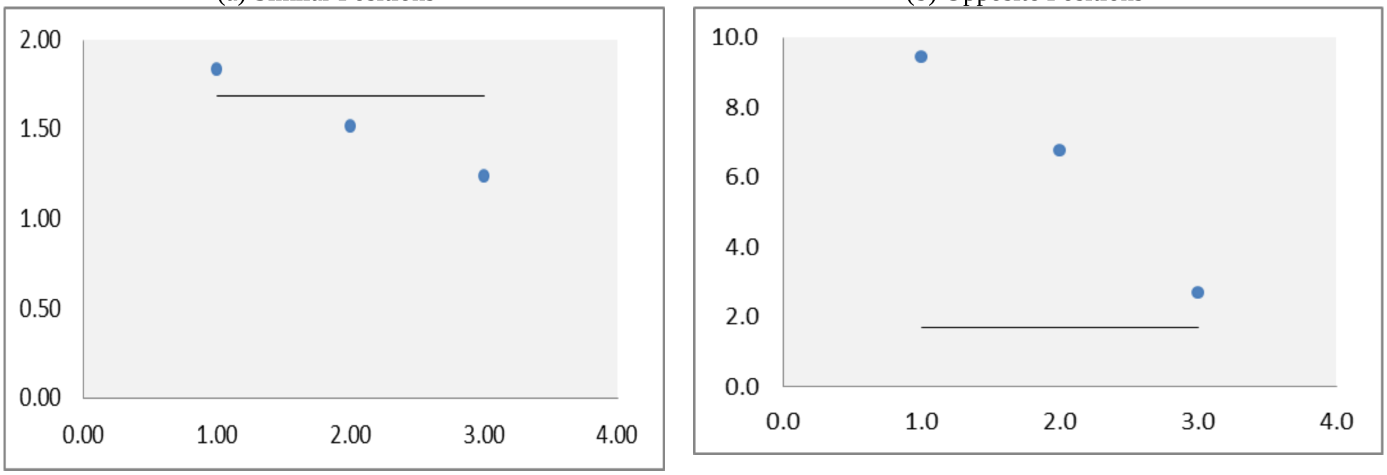


Figure 8.22: Variance Reduction as a Function of the Variance Ratio (with the exchange rate factor)—Oman

(a) Similar Positions (b) Opposite Positions

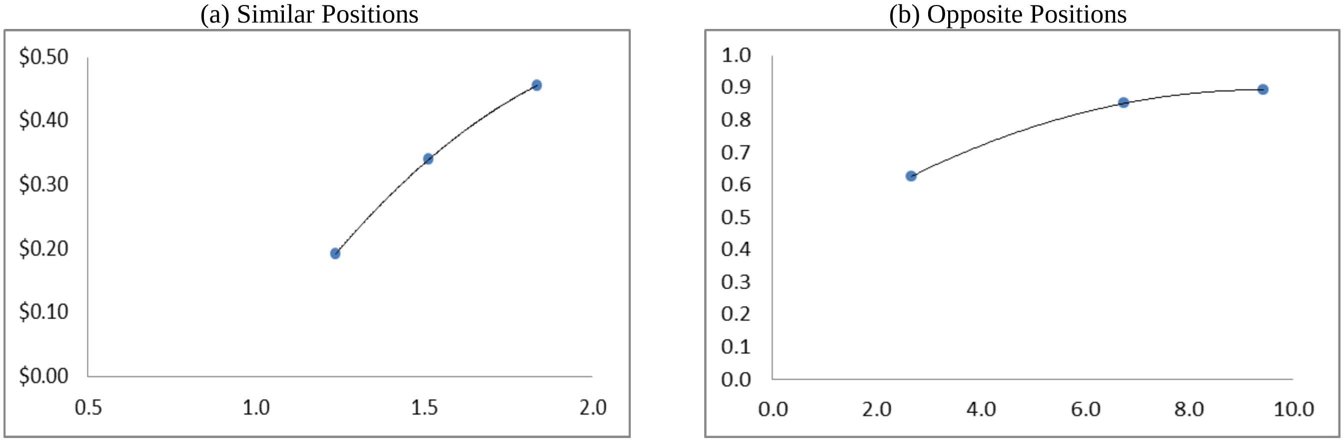


Figure 8.23: Variance Ratio against the 5% Critical Value (with the exchange rate factor)—Qatar

(a) Similar Positions (b) Opposite Positions

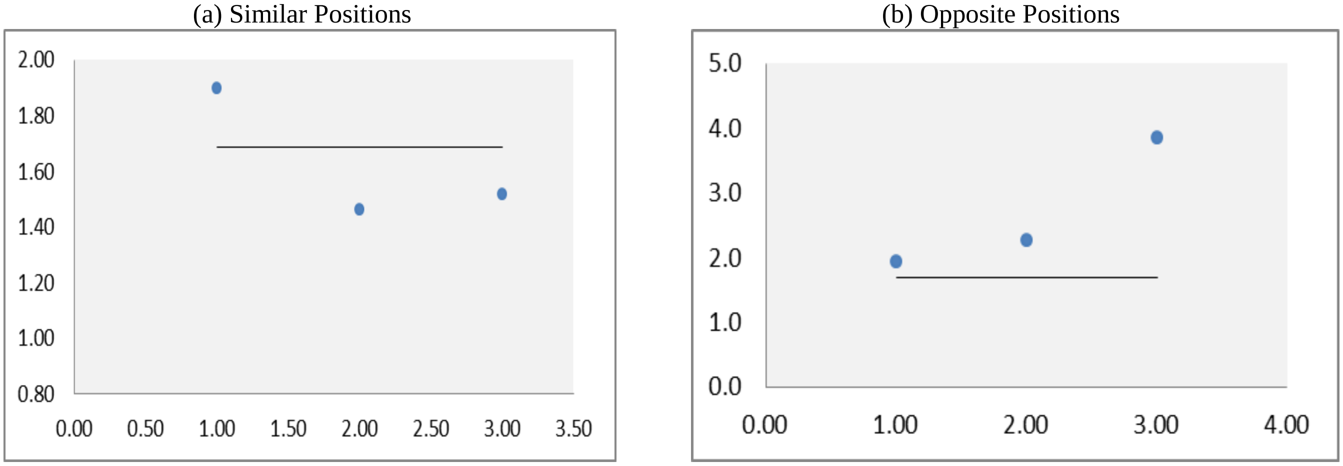


Figure 8.24: Variance Reduction as a Function of the Variance Ratio (with the exchange rate factor)—Qatar

(a) Similar Positions (b) Opposite Positions

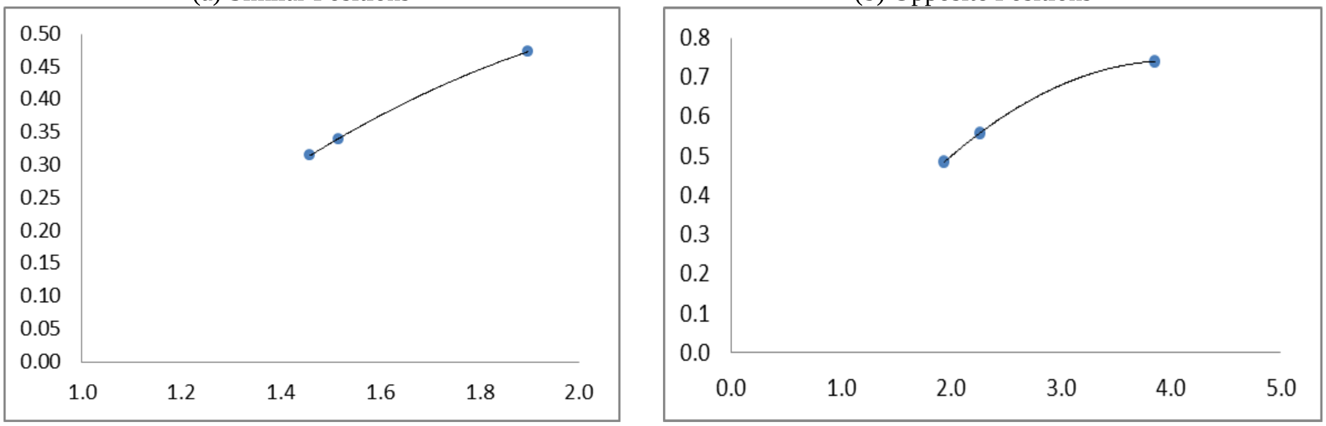


Figure 8.25: Variance Ratio against the 5% Critical Value (with the exchange rate factor)—UAE

(a) Similar Positions (b) Opposite Positions

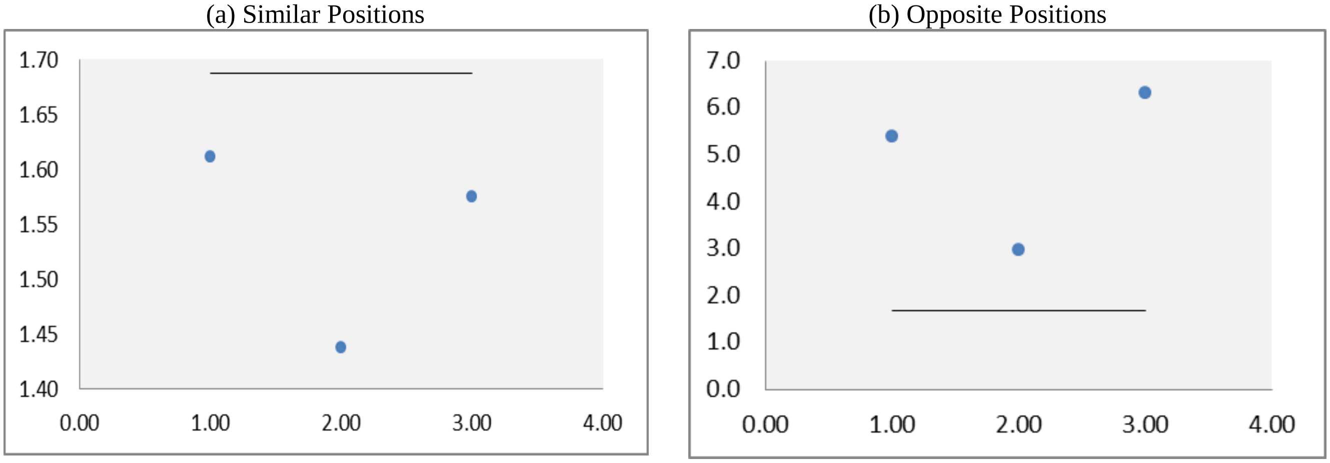
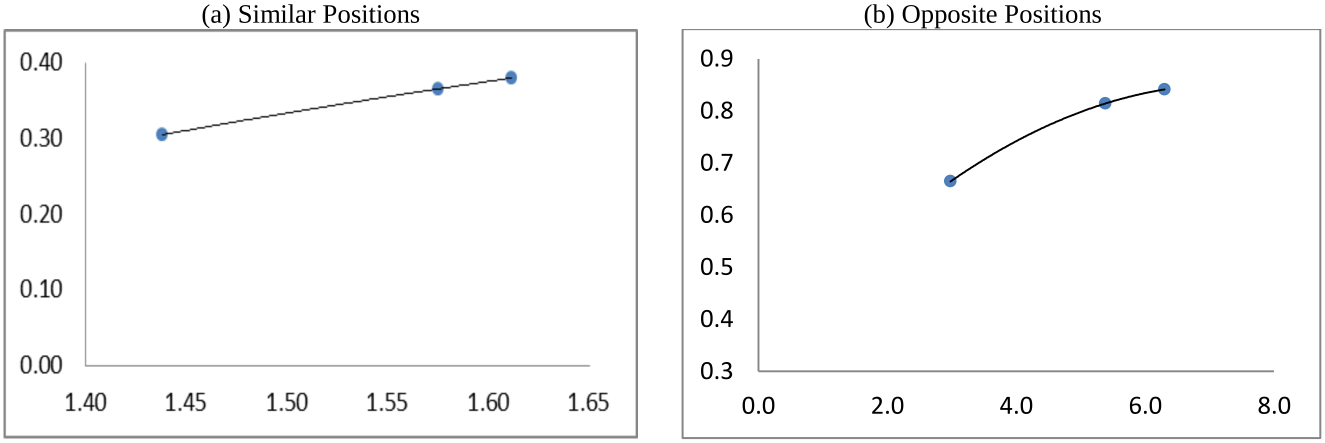


Figure 8.26: Variance Reduction as a Function of the Variance Ratio (with the exchange rate factor)—UAE

(a) Similar Positions (b) Opposite Positions



8.4 Conclusion

Financial economists have written about the benefits of international diversification so extensively that it has become a classic example of the intellectual tyranny of the status quo (with respect to current thinking on this issue). Typically, in situations like this, any empirical evidence against the underlying hypothesis is not taken to refute the hypothesis; rather, it is regarded as a puzzle. Numerous explanations for the alleged puzzle follow in an attempt to preserve the intellectual tyranny of the underlying hypothesis. However, none of these explanations refute the hypothesis.

If we do not shy away from the possibility of refuting a well-established hypothesis, then the results of this study suggest that home bias arises because diversification is not effective in reducing risk. As a result of more integration, increased correlations of stock returns in developed markets mean that risk cannot be reduced through diversification unless opposite positions are taken. While there is low correlation between two emerging markets and an emerging market and a developed market, it is not adequately low (or negative) to produce effective diversification by taking similar positions on the two markets.

Therefore, there are limited benefits of international diversification. Further, the costs and problems associated with it are non-trivial, as there are still some barriers to international investment, such as familiarity with foreign markets, political risk, efficiency of foreign markets, regulation, transaction costs, taxes and currency risk. For example, it is typically the case that transaction costs in foreign markets are higher, and they include brokerage fees, management fees and bid–offer spreads. Although the proponents of international diversification argue that these barriers are disappearing, they remain significant (particularly with respect to emerging markets). With limited benefits and significant problems associated with international diversification, it is little wonder that there is a home bias. However, this does not mean that international investment should be dropped from an investor's portfolio, as there are always special situations arising in markets around the world.

Chapter 9: Summary and Conclusions

9.1 Recapitulation

This thesis investigates research on the emerging financial markets of the GCC—specifically, the foreign exchange market and the stock market. This study aims to shed light on the issues encompassed in the two research questions:

1. Do foreign stock markets provide better investment opportunities than domestic markets, given that foreign investment involves exposure to foreign exchange risk?
2. Does international diversification provide a better risk-return trade-off than purely domestic portfolios?

To answer these questions, empirical analysis is conducted on 51 different time series covering nine stock prices, nine exchange rates and other macroeconomics variables such as money supply (nine time series), industrial production (three time series), government expenditure (six time series), interest rate (nine time series) and oil revenue (six time series). The nine stock prices are: (i) the domestic stock price indices of the GCC countries, and (ii) the three foreign stock prices of the US, UK and Japan. The nine exchange rates are those of the GCC currencies against: (i) the US dollar (USD), (ii) the British pound (GBP) and (iii) the Japanese yen (JPY).

Chapter 2 presents an economic overview of the GCC. The topics covered in Chapter 2 include output, GDP growth, consumer price inflation, fiscal position, interest rate, exchange rate and external account. Although the GCC countries have been experiencing a slowdown in economic growth (as a result of lower oil prices), they have a high credit rating, perhaps because they have large surpluses in their external account. Table 10.1 shows the credit ratings assigned to the GCC countries. High creditworthiness mitigates the effect of decreases in crude oil prices.

Table 9.1: Creditworthiness of GCC countries at the End of 2014

	S&P	Moody's	Fitch
Kuwait	AA	Aa2	AA
Saudi Arabia	AA-	Aa3	AA
Bahrain	BBB-	Baa3	BBB
Oman	A-	A1	NR
Qatar	AA	Aa2	AA
UAE	AA	Aa2	AA

The GCC countries are substantially dependent on crude oil exports to finance their economic growth and government expenditure, which makes these economies extremely sensitive to oil prices. The GCC countries can withstand a substantial decline of crude oil prices due to their vast financial wealth in the form of sovereign wealth funds and foreign exchange reserves. They are also in a position to access international financial markets. However, if crude oil prices continue to decline, there would be increasing pressure on policy makers to reform public finances on the revenue side by taking measures aimed at increasing taxes and boosting the share of non-oil revenue, as well as reforming the expenditure side by cutting subsidies, general expenditure and the public payroll. Chapter 2 also presents a history of the GCC stock markets and the associated trading mechanisms.

The main objective of Chapter 3 is to investigate the relation between the exchange rates and stock prices of the six GCC countries. The empirical results indicate that there is cointegration between stock prices and exchange rates in Kuwait, Bahrain and Oman. The Granger causality test reveals that exchange rates (in terms of the GBP) cause stock prices in all GCC countries, while stock prices cause exchange rates in Oman and Kuwait. Conversely, the empirical evidence indicates that exchange rates (in terms of the JPY) cause stock prices in Kuwait, while there is only one case of bidirectional causality between stock prices and exchange rates (the case of Oman).

In Chapter 4, forecasts for a variety of exchange rates are generated using the flexible-price monetary model and naïve random walk model, which were used by Meese and Rogoff (1983a) in their paper that gave rise to the notion of the 'Meese–Rogoff puzzle'. The accuracy of the forecasts generated by the random walk model and flexible-price monetary model is assessed using the conventional methodology applied by Meese and Rogoff. Another objective of Chapter 4 is to test and specify a forecasting model of the exchange rate for the GCC countries, which peg their currencies to the US dollar, except Kuwait, which pegs to a basket of currencies. Although the results firmly establish that the random walk model is unbeatable in terms of the magnitude of the forecasting error, this does not mean that it produces superior forecasts. Meese and Rogoff's results have been simplified over the years to imply that the random walk model cannot be outperformed by exchange rate models in out-of-sample (and in-sample) forecasting. However, such a statement must be qualified: the random walk model cannot be outperformed in terms of the magnitude of the forecasting error. This proposition is rejected when alternative measures of forecasting accuracy are used, as the results demonstrate that exchange rate models can outperform the random walk model in terms of DA. Therefore, the Meese–Rogoff puzzle only holds when forecasting accuracy is assessed by the magnitude of the forecasting error alone. Otherwise, it is not a puzzle at all.

Chapter 5 investigates the ability to forecast the stock prices of GCC countries using models based on macroeconomic variables including money supply, government expenditure, exchange rate, government revenue, interest rate, CPI and interest rate from 2001 to 2014. By applying cointegration tests, error correction modelling and causality testing on a monthly data set, some evidence is found of a long-run relation between stock prices and macroeconomic variables. However, the results are country- and variable-specific. Further, the forecasting results confirm the universality of the Meese–Rogoff results. They firmly establish that the random walk model is unbeatable in terms of the magnitude of the forecasting error, but this does not mean that it produces superior forecasts. The same result that holds for exchange rates also holds for stock prices.

The objective of Chapter 6 is to measure the profitability of stock trading in domestic (GCC) stock markets relative to foreign stock markets using a simple trading formula. The findings reveal that a trading rule based on a simple trading formula is more profitable in domestic stock markets than foreign markets (US, UK and Japan stock markets). However, this result cannot be generalised to any market or period.

Chapter 7 examines the advantages of international portfolio diversification without the exchange rate. Two methodologies were applied: variance reduction and variance ratio.

The results in the variance reduction test are mixed when similar (long) positions are taken. However, when opposite positions are taken, effective diversification appears in all cases, and risk is reduced by 35–90 per cent.

In Chapter 8, the benefits of international diversification are examined with due consideration given to the effect of the exchange rate factor, with returns measured in local currency terms. The results do not vary significantly, implying that the exchange rate factor has little effect.

9.2 Final Remarks

This study presents an extensive empirical investigation into the workings of the GCC stock markets. Several aspects of the markets have been highlighted and examined to set a foundation for further research. This study provides insights into international portfolio diversification for policy makers, economists and investors. It is hoped that this study will motivate further research into the interesting and stimulating issues addressed in this thesis.

References

Abken, P.A. and Shrikhande, M.M. (1997) The Role of Currency Derivatives in Internationally Diversified Portfolios, *Federal Reserve Bank of Atlanta Economic Review*, Third Quarter, 34-59.

Akdogan, H. (1996) A Suggested Approach to Country Selection in International Portfolio Diversification, *Journal of Portfolio Management*, 23, 33-39.

Adjaoute, K. and Tuchschmid, N.S. (1996) Exchange Rate Dynamics, Currency Risk and International Portfolio Strategies, *Finanzmarkt und Portfolio Management*, 10, 445-461.

Aggarwal, R. (2003). Exchange rates and stock prices: A study of the US capital markets under floating exchange rates. *Akron Business and Economic Review*, 12, 7-12.

Ajayi, R., Friedman, J., and Mehdian, M. (1998) On the Relationship between Stock Returns and Exchange Rates: Tests of Granger Causality. *Global Finance Journal*, 9, 241-251.

Al-Abduljader, S. (2009) An Empirical Investigation into the Working of An Emerging Stock Markets: The Case of Kuwait, PhD Thesis, La Trobe University.

Al-Abduljader, S. and Al-Muraikhi, H. (2011) The Profitability of Fundamental Trading Rules in Emerging Stock Markets: The Case of Kuwait, *International Journal of Economics and Finance*, 3, 223-234.

Alexander, S. (1964) Price Movements in Speculative Markets: Trends or Random Walks, *Industrial Management Review*, 5, 25-46.

Al-Muraikhi, H. (2005) Speculation in Emerging Financial Markets: The Case of Kuwait Stock and Foreign Exchange Markets, PhD Thesis, La Trobe University.

Allen, F. and Karjalainen, R. (1999) Using Genetic Algorithms to Find Technical Trading Rules, *Journal of Financial Economics*, 51, 245-271.

Al-Sharkas, A. (2004) The Dynamic Relationship between Macroeconomic Factors and the Jordanian Stock Market, *International Journal of Applied Econometrics and Quantitative Studies*, 1, 97-114.

Ashley, R., Granger, C. and Schmalensee, R. (1980) Advertising and Aggregate Consumption: An Analysis of Causality, *Econometrica*, 48, 1149-67.

Aydemir, O., Demirhan, E., (2009.) The relationship between stock prices and exchange rates: Evidence from Turkey, *International Research Journal of Finance and Economics*, 23, 207-215.

Baxter, M. and Jermann, U.J. (1997) The International Diversification Puzzle is Worse than you Think, *American Economic Review* 87, 170-180.

Bekaert, G. and Urias, M. (1996) Diversification, Integration and Emerging Market Closed-End Funds, *Journal of Finance*, 51, 835-869.

Bentzen, E. (2009) Monthly Seasonality in Exchange Rates and Stock Returns, *Applied Financial Economics*, 19, 1604-1610.

Biger, N. (1979) Exchange Risk Implications of International Portfolio Diversification, *Journal of International Business Studies*, 10, 64-74.

Black, F. (1995) Universal Hedging: Optimising Currency Risk and Reward in International Equity Portfolios, *Financial Analysts Journal*, January/February, 51, 1-5.

Bodnar, G., and Bartov, E. (1994) The Exchange Rates Exposure Effect, Earnings Expectations and Firm Valuation, *Journal of Finance*, 45, 1754-1786.

Boudoukh, J. and Richardson M. (1993) Stock Returns and Inflation: A Long Horizon Perspective, *American Economic Review*, 83, 1346-1355.

Brock, W., Lakonishok, J. and Lebaron, B. (1992) Simple Technical Trading Rules and the Stochastic Properties of Stock Returns, *Journal of Finance*, 47, 1731-1764.

Bugar, G. and Maurer, R. (1999) Efficient Risk Reducing Strategies by International Diversification: Evidence from a Central European Emerging Market, Working Paper. http://www.actuaries.org/AFIR/Colloquia/Tromsoe/Bugar_Maurer.pdf.

Capeland, L., and Wang, P. (2000) Forecasting the Return on U.K. Investment Trust; A comparison, *European Journal of Finance*, 6(3), 298-310.

Caporale, M., Howells P., and Soliman A. (2004) Stock Market Development and Economic Growth: The Causal Linkage, *Journal of Economic Development*, 29,33-47.

Chiang, T. (1991) International Asset Pricing and Equity Market Risk, *Journal of International Money and Finance*, 10, 349-364.

Chen, J. and Mark N. (1996) Alternative Long-Horizon Exchange-Rate Predictors, *International Journal of Finance and Economics*, 1, 229-250.

Chen, T., and Wu, H. (2001) Fish species diversity of Wulin Mountains region and its zoogeographic analyses. *Journal of Shanghai Fisheries University*, 10(1):6-15.

Cheung, Y. and Chinn, M. (1998) Integration, Cointegration, and the Forecast Consistency of Structural Exchange Rate Models, *Journal of International Money and Finance*, 17, 813-830.

Cheung, Y.-W., Chinn M., and Pascual A. (2005) Empirical Exchange Rate Models of the Nineties: Are Any Fit to Survive?, *Journal of International Money and Finance,* 24, 1150-1175.

Choe, H., Kho, C., and Rene M. Stulz (2000) Do Domestic Investors Have More Valuable Information About Individual Stocks Than Foreign Investors?, *NBER Working Paper* No. 8073.

Coval, Joshua D., and Moskowitz, Tobias J. (1999) Home Bias at Home: Local Equity Preference in Domestic Portfolios, *Journal of Finance,* 54, 2045–2073.

Conover, W.J. and Johnson, M.E. (1981) A Comparative Study of Tests for Homogeneity of Variance with Applications to Outer Continental Shelf Bidding Data, *Journal of the American Statistical Association*, 23, 351-361.

Conover, C.M. Jensen, G.R., Johnston, R.R. (2002) Emerging Markets: When are they Worth it?, *Financial Analyst Journal,* March/April, 86-95.

Cushman, D. (2003) A Portfolio Balance Approach to the Canadian-U.S. Exchange Rate, *Review of Financial Economics*, 16, 305–320.

Curcio, R. and Goodhart, C. (1991) Chartism: A Controlled Experiment, Discussion Paper, London School of Economics.

Dahlquist, M., Pinkowitz, L., and Stulz, R. (2002) The Corporate Governance and the Home Bias, *Journal of Financial and Quantitative Analysis*, 38, 87-110.

Delpachitra, S., Yakob, A., and Beal, D. (2005) the Asia Pacific Stock Markets Seasonality, *Journal of Asset Management,* 5, 297-316.

Dickey, D. and Fuller, W. (1979) Distribution of the Estimators for Autoregressive Time Series with a Unit Root, *Journal of the American Statistical Association*, 74, 427-431

Diebold, X. and Lopez, J. (1996) Forecast Evaluation and Combination, *Econometrica*, 41, 30-34.

Dornbusch R. (1976) Expectations and Exchange Rate Dynamics, *The Journal of Political Economy*, 84, 1161-1176.

Dornbusch, R. and Fischer, S. (1980) Exchange Rates and the Current Account, *American Economic Review*, 70, 960-971.

Dvorak, S., Jordon, P., Hodge and J.L. Romero (2000) Assessing evolutionary relationships of pines in the Oocarpae and Australes subsections using RAPD markers. *New Forests*, 20(2):163-192

Driessen, J. and Laeven, L. (2007) International Portfolio Diversification Benefits: Cross-Country Evidence from a Local Perspective, *Journal of Banking and Finance*, 31, 1693-1712.

Dzhabarov, C. and Ziemba, T. (2010) Do Seasonal Anomalies Still Work?, *Journal of Portfolio Management*, 36, 93-104.

Elliott, G., Rothenberg, T.J., and Stock J.H. (1996) Efficient Tests for an Autoregressive Unit Root, *Econometrica*, 64, 813–836.

Engle, R. and Granger, C., (1987) Cointegration and Error Correction: Representation, Estimation and Testing, *Econometrica*, 55, 251-276.

Engel C. and West K. (2005) Exchange Rates and Fundamentals, *Journal of Political Economy*, 113, 485-517

Engel C. (2006) Taylor Rules and the Deutschmark-Dollar Real Exchange Rate, *Journal of Money, Credit, and Banking*, 38, 1175-1194.

Eun, C.S. and Resnick, B.G. (1988) Exchange Rate Uncertainty, Forward Contracts, and International Portfolio Selection, *Journal of Finance,* 43, 197-215.

Eun, C.S. and Resnick, B. (1994) International Diversification of Investment Portfolios: U.S. and Japanese Perspectives, *Management Science*, 40, 140-160.

Fama, E. (1965) The Behaviour of Exchange Rates and Stock Market Prices, *Journal of Business*, 38, 34–105.

Fama, E. (1984) Spot and Forward Rates, *Journal of Monetary Economics*, 14, 319-338.

Fama, E. (1970) Efficient Capital Markets: A Review of Theory and Empirical Work, *Journal of Finance*, 24, 382-418.

Fama E. and M. E, Blume (1966) Filter Rules and Stock Market Trading, *Journal of Business*, 39, 226-241.

Fama E. and Schwert, W. (1977) Asset Returns and Inflation, *Journal of Financial Eonomics* , 5, 115-146.

Fisher, I. (1930) *The Theory of Interest*, New York: Macmillan.

Frankel J. (1976) Amonetary Approach to the Exchange Rate: Doctrinal aspects and empirical evidence, *Scandinavion Journal of Economics*, 78, 200-224.

Frankel J. (1984) Tests of Monetary and Portfolio Balance Models of Exchange Rate Determination, in J.F.O. Bilson and R.C. Marston (eds.) *Exchange Rate Theory and Practice*, Chicago: University of Chicago Press.

Frankel, J. and Froot, K. (1990) The Rationality of the Foreign Exchange Rate: Chartisits, Fundamentalist and Trading in the Foreign Exchange Market, *American Economic Review*, 80, 181-185.

Frankel, J. and. Rose, A. (1996) A Panel Project of Purchasing Power Parity: Mean Reversion within and between Countries, *Journal of International Economics*, 40, 209-224.

French, K. and Poterba, J. (1991) Investor Diversification and International Equity Markets, *American Economic Review*, 81, 222-226.

Froot, A., and Ramadorai, T.(2005) Currency Returns, Intrinsic Value and Institutional Investor Flows, *Journal of Finance*, 60, 1535-1566.

Ghartey, E. (1988) Monetary Dynamics in Ghana: Evidence from Cointegration, Error Correction Modelling, and Exogeneity, *Journal of Development Economics*, 60, 203-233.

Glen, J. and Jorion, P. (1993) Currency Hedging for International Portfolios, *Journal of Finance*, 48, 1865-1886.

Goetzmann, W., Li, L. and Rouwenhorst, K. (2005) Long-term Global Market Correlations, *Journal of Business*, 78, 1-38.

Goodacre, A. and Kohn-Speyer, T. (2001) CRISMA Revisited, *Applied Financial Economics*, 11, 221-30.

Gourinchas, P. and Tornell, A. (2002) Exchange Rate Dynamics, Learning and Misperception, NBER Working Papers, No. 939.

Granger, C. (1969) Investigating Causal Relations by Econometric Models and Cross-Spectral Methods, *Econometrica*, 37, 424-439.

Griffiths, E., Carter E., George G. and Hill J. (1993) *Practicing and Learning Econometrics*, New York: Wiley.

Grinblatt, M. and Keloharju, M. (1998) A generalization of the binomial test statistic to autoregressive sample draws. Mimeo, University of California at Los Angeles.

Grinblatt, M. and, Keloharju, M. (2001) What makes investors trade?, *Journal of Finance*,56, 589-616.

Grubel, H.G. (1968) Internationally Diversified Portfolios, *American Economic Review* 68, 1299-1314.

Grubel, H.G. and Fander, K. (1971) The Interdependence of International Equity Markets, *Journal of Finance*, 26, 89-94.

Gultekin, M. (1983) Seasonality Stock Market: International Case, *Journal of Financial Economics,* 11, 468-483.

Hassan, M. and Naka, A. (1996) Short-run and Long Run Dynamic Linkages among International Stock Markets, *International Review of Economics and Finance*, 5, 387-405.

Hau, H., 2001. Location matters: An Examination of Trading Profits, *Journal of Finance*, 56, 1951-1983.

Hatemi, A., Irandoust, M. (2002) On the causality between exchange rates and stock prices: A note, *Bulletin of Economic Research,* 54 (2), 197-203.

Hatemi, A, and Rocab, E. (2004) An Examination of the Equity Market Price Linkages Between Australia and the European Union Using Leveraged Bootstrap Method. *European Journal of Finance*, 10, 6, 475-488.

Higgs, H and Worthington, A. (2006) Weak form Market Efficiencies in Developed Equity and Asian Emerging Markets: Comparative Test of Random-Walk Behaviour, *Accounting Research Journal*, 18, 53-64.

Hin, C.W., Kuo, J. and Lee, C.E (1994) A New Measure to Compare the Hedging Effectiveness of Foreign Currency Futures versus Options, *Journal of Future Markets*, 14, 685-707.

Hlouskova, J. and Wagner, M. (2009) Finite Sample Correction Factors for Panel Cointegration Tests, *Oxford Bulletin of Economics and Statistics*, Department of Economics, University of Oxford, 71(6), 851-881.

Horioka C. and Feldstein M. (1980) International Capital Flows and Domestic Savings, *Economic Journal*, 5, 313-330.

Hudson R., Dempsey, M., Keasey, K. (1995) A note on the weak and efficiency of capital market: The application of simple technical trading rules to UK stock price – 1935 to 1994, *Journal of Banking & Finance*,20, 1121-1132.

Isakov, D. and Hollistein, M. (1998) Application of Simple Technical Trading Rules to Swiss Stock Prices: Is It Profitable? Working Paper, HEC, University of Geneva, Geneva.

Izan, Y. and Ong, L. (1999) Stock and Currencies: Are They Related?, *Applied Financial Economics*, 9, 523-532.

Jobson, J.D. and Korkie, B.M. (1981a) Putting Markowitz Theory into Work, *Journal of Portfolio Management*, 7, 70-74.

Jobson, J.D. and Korikie, B.M. (1981b) Performance Hypothesis Testing with the Sharpe and Treynor Measures, *Journal of Finance,* 36, 889-908.

Johansen, S. and Juselius, K. (1990) Maximum Likelihood Estimation and inference on Cointegration with Application to the Demand for Money, *Oxford Bulletin of Economics and Statistics*, 52, 169-210.

Johnston, R. and Sun, Y. (1997) Some Evidence on Exchange Rate Determination in Major Industrial Countries, *IMF Working Paper*, WP/97/98.

Johansen, S. (1991) Estimation and Hypothesis testing of Cointegration Vector in Gaussian Vector Autoregressive Models, *Econometrica*, 59, 1551-1581.

Jon, F., John, H. Rogers and Jonathan H. Wright (2001) Exchange Rate Forecasting: The Errors We've Really Made, International Finance Discussion Paper, Number 714, Board of Governors of the Federal Reserve System.

Jordan, P. and Giovannini, A. (1987) Interest Rates and Stock Premia in the Stock Market and in the Foreign Exchange Market, *Journal of International Money and Finance*, 6, 107-123.

Jorion, P. (1985) International Portfolio Diversification with Estimation Risk, *Journal of Business* 58, 259-278.

Jorion, P. (1986) Bayes-Stein Estimation for Portfolio Analysis, *Journal of Financial and Quantitative Analysis,* 21,279-292.

Jorion, P. (1989) Asset Allocation with Hedged and Unhedged Foreign Stocks and Bonds, Jorion, P. (1994) Mean/Variance Analysis of Currency Overlays, *Financial Analysts Journal*, April, 48-56.

Kallberg, J.G. and Ziemba, W.T. (1984) Mis-specification in Portfolio Selection Problems, in G. Bamberg and K. Spremann (eds.) Risk and Capital, Lecture Notes in Econometrics and Mathematical Systems, Berlin: Springer-Verlag.

Kalra, R., Stoichev, M. and Sundaram, S. (2004) Diminishing Gains from International Diversification, *Financial Services Review*, 13, 199-213.

Kalyanaraman, L. and Basmah, T. (2014) A Study of the Effect of Macroeconomic Variables on Stock Market: Saudi Perspective, *International Journal of Financial Research*, 5, 121-126.

Kandir, Y. (2008) Macroeconomic Variables, Firm Characteristics and Stock Returns: Evidence from Turkey, *International Research Journal of Finance and Economics*, 2, 35-38.

Kang, J. and Stulz, R. (1997) Why There is a Home Bias? An Analysis of Foreign Portfolio Equity Ownership in Japan, *Journal of Financial Economics*, 46, 3-28.

Kaplanis E., and Cooper, I. (1994) Home Bias in Equity Portfolios, Inflation Hedging, and International Capital Market Equilibrium, *Review of Financial Studies*, 7, 45-60.

Kavlanis, C. (1988) Forecasting and Stability of the Co-movement, Measures of International stock Market Returns, *Journal of International Money and Finance* 7, 63-75.

Keim, D., Marsh, T. and Brown, P. (1983) Seasonality's Exchange Rates and Stock Return and the Tax Loss Selling Hypothesis: Australian Case, *Journal of Financial Economics*, 11, 106-128.

Kemmerer, E.W. (1911) New York Money Market Seasonal Variations, *American Economic Review* 1, 33-49.

Khan, F., Akbar, M. and Ali, S. (2012) The Relationship between Macroeconomic Variables and Stock Prices revisited: Karachi Stock Exchange case, *African Journal of Business Management*, 6, 1314-1323.

Kilian, L. and Taylor, M. (2003) Why is it so Difficult to Beat the Random Walk Forecast of Exchange Rates?, *Journal of International Economics*, 60, 85–107.

Klugman, S. (1992) *Bayesian Statistics in Actuarial Science with Emphasis on Credibility*, Alphen aan den Rijin (Netherlands): Kluwer Academic Publishers.

Kremers, J., Ericson, N. and Dolado, J.D. (1992) The Power of Cointegration Tests, *Oxford Bulletin of Economics and Statistics* 54, 325–348.

Karamustafa, O. and Kucukkale, Y. (2003) Long Run Relationships between Stock Market Returns and Macroeconomic Performance: Evidence from Turkey, *International Research Journal of Finance and Economics*, [Online] Available at: https://core.ac.uk/download/files/153/9315502.pdf.

Kutty G. (2010) Measuring the Relationship among the Exchange Rates and Stock Price, *North American Journal of Finance and Banking Research*, 4, 8-12.

Kwiatkowski, D., Phillips, P., Schmidt, P. and Shin, Y. (1992) Testing the Null Hypothesis of Stationary against the Alternative of Unit Root, *Journal of Econometrics*, 54, 159-178.

Laker, D. (2003) Benchmark Rebalancing Calculations, *Journal of Performance Measurement*, 7, 8-23.

Laker, M.R. and Grant, D.M. (1990) Currency Hedging Strategies for Internationally Diversified Equity Portfolios, *Journal of Portfolio Management*, Fall, 30-32.

Larsen, A. and Resnick, G. (2000) The Optimal Construction of Internationally Diversified Equity Portfolios Hedged Against Exchange Rate Uncertainty, *European Financial Management*, 6, 479–514.

Lassard, D.R. (1976) World, Country and Industry Relationships in Equity Returns: Implications for Risk Reduction through International Diversification, *Financial Analysts Journal*, 32, 32-38.

Lebaron, B. (1999) Technical Trading Rule Profitability and Foreign Exchange Intervention, *Journal of International Economics*, 49, 125-143.

Lee, C. and Nieh, C. (2001) Dynamic Relationship between Stock Prices and Exchange Rate for G7 Countries, *Quarterly Review of Economics and Finance,* 41, 477-490.

Lessaed, R. (1973) International Portfolio Diversification: Multivariate Analysis for a Group of Latin American Countries, *Journal of Finance*, 28, 619-633.

Levy, H. and Sarnat, M. (1970) International Diversification of Investment Portfolios, *American Economic Review*, 60, 668-675.

Levy, H. (1973) Stochastic Dominance, Efficiency Criteria and Efficient Portfolios: The Multi-period Case, *American Economic Review*, 63, 986-994.

Levy, H. and Lim, C. (1994) Forward Exchange Bias, Hedging and the Gains from International Diversification of Investment Portfolios, *Journal of International Money and Finance,* 13, 159-170.

Levy, H. (1998) *Stochastic Dominance: Investment Decisions under Uncertainty*, New York: Kluwer Academic Publishers.

Lew, H. and Kroll, Y. (1978) Ordering Uncertain Options with Borrowing and Lending, *Journal of Finance*, 33, 553-573.

Lew, H. (1992) Stochastic Dominance and Expected Utility: Survey and Analysis, *Management Science*, 38, 555-593.

Lewis, K. (2006) Is the International Diversification Potential Diminishing? Foreign Equity Inside and Outside the U.S, NBER Working Papers, No. 12697.

Li, B. and Liu, B. (2010) Day-of-the-Week Effects: Evidence from Top 50 Australian Stocks, *European Journal of Economics, Finance and Administrative Sciences,* 24, 78-87.

Li, M. (2011) An Evaluation of Exchange Rate Models by Carry Trade, *Journal of Economics and International Finance*, 3, 72-87.

Liljeblom, E., Loflund, A. and Krofors, S. (1997) The Benefits from International Diversification for Nordic Investors, *Journal of Banking and Finance*, 21,469-490.

Longion, F. and Solin, B. (1995) Is the Correlation in International Equity Returns Constant: 1960-1990?, *Journal of International Money and Finance,* 14, 3-26.

Maat, B., Driesprong, G., and Jacobsen, B. (2004) Oil Prices and Stock Markets, Unpublished Paper, Rotterdam School of Management, Erasmus University.

MacDonald, R. and Taylor M. (1992) Exchange Rate Economics: A Survey, *International Monetary Fund Staff Papers*, March, 1-57.

MacDonald, R. and Marsh, I.W. (1994) On Casselian PPP, Cointegration, and Exchange Rate Forecasting, Manuscript, University of Strathclyde: Glasgow.

Maddala, S. (1992) Rational Expectations in Limited Dependent Variable Models, *Journal of Monetary Economics*, 12, 432-561.

Mark, N.C. (1995) Exchange Rates and Fundamentals: Evidence on Long-Horizon Predictability, *American Economic Review*, 85, 201-218.

Masson, P. and Branson, W. (1977) Exchange Rate in the Short Run: the Dollar Deutsche Mark Rate, *European Economic Review*, 10, 303-324.

Maysami, R. and Sims, H. (2002) Macroeconomics Variables and their Relationship with Stock Returns: Error Correction Evidence from Hong Kong and Singapore, A*sian Economic Review*, 44, 69-85.

Maysami, R., Howe, L., and Hamzah, A. (2004) Relationship between Macroeconomic Variables and Stock Market Indices: Cointegration Evidence from Stock Exchange of Singapore's All Sector Indices, *Journal Pengurusan*, 24, 47-77.

Mehdian, S., Friedman, J., and Ajayi, R.A. (1998) On the relationship between Stock Returns and Exchange Rates: Test of Granger Causality, *Global Finance Journal*, 9 (2), pp. 241-251.

Meese, R. and Rogoff .K (1983a) Empirical Exchange Rate Models of the Seventies: Do they fit the Out of Sample?, *Journal of International Economics,* 14, 3-24.

Metin, K. and Muradoglu, G. (1996) Efficiency of the Turkish Stock Exchange with Respect to Monetary Variables: A Cointegration Analysis, *European Journal of Operational Research*, 90, 566-576.

Meredith, G. and Chinn, M. (1998) Long-Horizon Uncovered Interest Rate Parity, NBER Working Papers, 6797.

Mills, T. (1998) Technical Analysis and the London Stock Exchange: Testing Trading Rules Using the FT30, *International Journal of Finance and Economics*, 2, 319-331.

Mishkin, F. (2003) *The Economics of Money, Banking and Financial Markets* (7th ed.), Boston: Pearson.

Mok, H. (1993) Causality of Interest Rate, Exchange Rate and Stock Prices at Stock Market Open and Close in Hong Kong, *Asia Pacific Journal of Management*, 10, 123-143.

Molodtsova, T., and Papell, D. (2007) Out-of-Sample Exchange Rate Predictability with Taylor Rule Fundamentals, *Journal of International Economics*, 77, 167-180.

Moosa, I., and Al-Loughani, E. (2003) The Role Fundamentals and Technicians in the Foreign Exchange Market when the Domestic Currency Pegged to a Basket, *Applied Financial Economics*, 13, 79-84.

Moosa, I.A. (2013) Why is it so Difficult to Outperform the Random Walk in Exchange Rate Forecasting?, *Applied Economics*, 45, 3340-3346.

Moosa, I.A. and Al-Deehani, T. (2009) The Myth of International Diversification, *Economia Internazionale*, 62, 1-24.

Moosa, I.A. and Al-Abudlijader, S. (2006) Is Price-Volume Relationship Symmetric? Cross Sectional Evidence from an Emerging Stock Market, Journal of investment Management and Financial Innovation, 3, 80-90.

Moosa, I.A. and Burns, K. (2013) A Reappraisal of the Meese-Rogoff Puzzle, *Applied Economics,* 46, 30-40.

Moosa, I.A (2002) A Test of News Model of Exchange Rates, *Weltwirtschafitic Archiv*, 138, 694-710.

Moosa, I.A. and Burns, K. (2014) The Unbeatable Random Walk in Exchange Rate Forecasting: Reality or Myth? *Journal of Macroeconomics*, 40, 69-81.

Moosa, I.A. and Korczak, M. (2000) Is Price-Volume Relationship Symmetric in Future Market? *Journal of Financial Studies*, 7, 1-15.

Moosa, I.A. and Ramiah, V. (2013) Emerging Market Stocks in Global Portfolios: A Hedging Approach, in Boubaker, S. and Nguyen, D. (eds) *Emerging Markets and the Global Economy: A Handbook*, Amsterdam, Elsevier.

Moosa, I.A., Tawadros, G. and Hallahan, T. (2015) The Effectiveness of International Diversification: Whole Markets versus Sectors, *Applied Economics*, 47, 614-622.

Moses, A. and Bonin, M. (1974) Seasonal Variations in Prices of Individual Dow Jones Industrial Stocks, *Journal of Financial and Quantitative Analysis,* 9, 963–91.

Muhammad, N. and Rasheed, A. (2002) Stock Prices and Exchange Rates: Are they related? Evidence from South Asian Countries, *Pakistan Development Review,* 41, 535-550.

Murinde, V., and Abdalla, A. (1977) The Stock Price and Exchange Rate Interaction in Emerging Market: Evidence of Korea, Philippines, Pakistan, and India, *Applied Financial Economics,* 8, 26-36.

Naka, A., and Mukherjee, K. (1995) Dynamic Relations among the Japanese Stock Market and Macroeconomic Variables: An application of a VECM, *Journal of Financial Research*, 2, 222-239.

Narayan, P. K., (2005) Are the Australian and New Zealand Stock Prices Nonlinear with a Unit Root?, *Applied Economics*, 37, 2161-2166.

Nelson, C. (1976) Inflation and Rates of Return on Common Stocks, *Journal of Finance*, 31, 472-484.

Nelson, C. and Plosser, C. (1982) Trends and Random Walks in Macroeconomic Time Series: Some Evidence and Implications, *Journal of Monetary Economics*, 10, 139-162.

Neely, C. and Sarno, L.(2002) How Well Do Monetary Fundamentals Forecast Exchange Rates, *Review*, Federal Reserve Bank of St. Louis, September, 51-74.

Newbold, P. and Granger, C. (1974) Spurious Regressions in Econometrics, *Journal of Econometrics*, 2, 111-120.

Nieh, C. and Lee, F. (2001) Dynamic Relationship between Stock Prices and Exchange Rates for G-7 Countries, *Quarterly Review of Economics and Finance*, 41, 477–490.

Ogunmuyiwa, S. and Asaolu, O. (2011) An Econometric Analysis of the Effect of Macroeconomic Variables on Stock Market Movement: Evidence of Nigeria, *Asian Business Management Journal*, 3, 71-79.

Ojah, K. and Karemera, D. (1999) Random Walks and Market Efficiency Tests of Latin American Emerging Equity Markets: A Revisit, *Financial Review*, 34, 57-72.

Ong, L. and Cao, Y. (1995) Monetary Model of Exchange-Rate Determination and Purchase Power Parity, Working Paper: Nanying Business School.

Parham, P. and Hooi, H.L. (2011) The Analysis of Relationship between Stock Prices and Exchange Rates: Evidence from Six Middle Eastern Financial Markets, *International Research Journal of Finance and Economics*, 66, 159-163.

Pesaran, M. Hashem; Shin, Yongcheol and Smith, Ron P. (1999) Pooled Mean Group Estimation of Dynamic Heterogeneous Panels. *Journal of the American Statistical Association*, 94(446), 621-34.

Pindyck, R., Rubinfeld, S. and Daniel, L. (1998) *Econometric Models and Economic Forecasts*, New York: Irwin/McGraw-Hill.

Poterba, J. and French, K. (1991) International Equity Markets and Investor Diversification, *American Economic Review*, 89, 222-226.

Qi, M. and Wu, Y. (2001) Technical Trading-Rule Profitability, Data Snooping, and Reality Check: Evidence from the Foreign Exchange Market, Unpublished Manuscript, Rutgers University.

Roll, R., Chen, N. and Ross, S. (1986) the Stock Market and Economic Forces, *Journal of Business*, 59, 383-403.

Ramasamy, B. and Yeung, M. (2005) the Causality Between Stock Returns and Exchange Rate: Revisited, *Australian Economic Paper*, 44,162-169.

Raj, M. (1988) Dis-equilibrium of Futures Markets: An Intra-Day Investigation, Paper presented at the British Accounting Association Annual Conference, Manchester.

Ravazzolo, F. and Phylaktis, K. (2005) Stock Prices and Exchange Rate Dynamics, *Journal of International Money and Finance*, 24, 1031-1053.

Rowland, P.F. (1999) Transaction Costs and International Portfolio Diversification, *Journal of International Economics*, 49, 45-170.

Russel, J.W. (1998) The International Diversification Fallacy of Exchange-Listed Securities, *Financial Services Review*,7, 95-106.

Sacciavillani, F. and Sjaastad, L. (1996) The Price of Gold and Exchange Rates, *Journal of International Money and Finance*, 15, 879-897.

Sadka, R. and Heston, L. (2008) Seasonality in the Cross-section of Stock Returns, *Journal of Financial Economics*, 87, 418–445.

Sadorsky, P. and Basher, S.(2004) Emerging Stock Markets and Oil Price Risk, Working Paper, Department of Economics, York University.

Schwert, W. and Plosser, C. (1978) Money, Income, and Sunspots: Measuring Economic Relationships and the Effect of Differencing, *Journal of Monetary Economics*, 4, 637-660.

Schwert, W. (1989) Tests for Unit Roots: A Monte Carlo Investigation, *Journal of Business and Economic Statistics*, 7, 147-159.

Sharma, C., and Wongbampo, P. (2002) Macroeconomic Fundamental and Stock Market and Dynamic Interactions: 5 Asia Countries, *Journal of* Asian *Economics*, 13, 26-53.

Sharma, C., and Ratanapakorn, O. (2007) Dynamics Analysis among the Macroeconomics Variables and the US Stock Return, *Applied Financial Economics*, 17, 368-378.

Sharili, Y., Selvarathinam S., and Younis, M. (2008) Economic Growth and Political Stability in Asia, *American Journal of Applied Sciences*, 5, 19-26.

Sellin, P. (2001) Monetary Policy and the Stock Market: Theory and Empirical Evidence, *Journal of Economic Surveys*, 15, 491-541.

Maysami, R. C. and Sim, H. H. (2002a) Macroeconomics variables and their relationship with stock returns: error correction evidence from Hong Kong and Singapore, *The Asian Economic Review*, 44(1), 69-85.

Sohrabiab, A. and Bahmani, M. (1992) Stock Price and the Effective Exchange Rates of the Dollar, *Applied Economics*, 24, 459-464.

Solnik, B.H. (1974) Why not Diversify Internationally?, *Financial Analyst Journal,* 30, 48-54.

Solnik, B.H. (1987) Using Financial Prices to Test Exchange Rate Models: A Note, *Journal of Finance*, 42, 141-149.

Stavarek, D. (2004) Stock Prices and Exchange Rates in the EU and the USA: Evidence of Mutual Interactions, *Journal of Economics and Finance*, 55, 141-161.

Stein, J. and Hong, H. (1999) A Unified Theory of Under Reaction, Momentum Trading and Overreaction in Asset Markets, *Journal of Finance*, 54, 2143-2148

Swamy, B. and Schinasi, J., (1989) The out-of-sample forecasting performance of exchange rate models when coefficients are allowed to change, International Finance Discussion Papers, No. 287, Federal Reserve Board, Washington, D.C.

Sul, D. and Mark, N. (2001) Monetary Fundamentals and Nominal Exchange Rates: Evidence from a Small Post Bretton Woods Panel, *Journal of International Economics*, 52, 30-53.

Tabak, B. (2006) The Dynamic Relationship between Stock Prices and Exchange Rates: Evidence for Brazil, *International Journal of Theoretical and Applied Finance*, 9, 1377-1396.

Taylor, J. (1993) Discretion versus Policy Rules in Practice, *Carnegie-Rochester Conference Series on Public Policy*, 39, 195-214.

Taylor, M. and Allen, H. (1992) The use of Technical analysis in the foreign Exchange Market, *Journal of International Money Finance*, 1193),304-314.

Taylor, M. and Sarno L. (1998) The Behavior of Real exchange Rates during the Post-Bretton Woods period, *Journal of International Economics*, 46, 281–312.

Thoma, M. (2008) FRB Dallas: Why Are Exchange Rates So Difficult to Predict?, *Economonitor*, 22 July 2008.

Tooke, T. (1824) *Thoughts and Details of High and Low Prices of the Thirty Years, from 1793 to 1822, in Four Parts*, 2nd edn, London: John Murray.

Torous, W., Hong, H. and Valkanov, R. (2003) Do Industries Lead Stock Markets, Working Paper. http://www.princeton.edu/~hhong/industry-12-05-05.pdf.

Tursoy, T., Gunsel, T. and Rjoub, H. (2008) Macroeconomic Factors, the APT and the Istanbul Stock Market, *International Research Journal of Finance and Economics*, [Online] Available at: http://www.eurojournals.com/irjfe_22_04.pdf.

Uddin, J. and Rahman, M. (2009) Dynamic Relationship between Stock Prices and Exchange Rates: Evidence from Three South Asian Countries, *International Business Research*, 2, 167-174.

Wang, F. (1998) Strategic Trading, Asymmetric Information and Heterogeneous Prior Beliefs, *Journal of Financial Markets*, 1, 321-352.

Wang, J. (2006) Can Long Horizon Data Beat Random Walk Under Engel-West Explanation?, Working Paper No. 36, University of Wisconsin.

Warnock, E. (2002) High Turnover and Home Bias Reconsidered, *Journal of International Money and Finance*, 21, 794-806.

Werner, M., and Tesar, L., (1995) High Turnover and Home Bias, *Journal of International Finance,* 14, 550-551.

Wilson, I. (2009) The Monetary Approach to Exchange Rates: A Brief Review and Empirical Investigation of Debt, Deficit, and Debt Management: Evidence from the United States, *Journal of Business Inquiry*, 8, 83-99.

Wohar A., Rapach S., David E. and Mark E. (2001) Testing the Monetary Model of Exchange Rate Determination: New Evidence from a Century of Data, *Journal of International Economics,* 59, 101-120.

Wolff, P. (1988) Exchange Rates, Innovations and Forecasting, *Journal of International Money and Finance*, 7, 49-61.

Wolfenson, D. and Shleifer, A. (2002) Equity Markets and Investor Protection, *Journal of Financial Economics*, 65, 4-28.

Wu,Y. (2001) Exchange Rates, Stock Prices and Money Markets: Evidence from Singapore, *Journal of Asian Economics*,12, 445-458.

Yau, H., and Nieh, C. (2006) Interrelationships among stock prices of Taiwan and Japan and NTD/Yen exchange rate, *Journal of Asian Economic*, 17, 535-552.

Younis, M., Sharili, X., and Selvarathinam S., (2008) Political Stability and Economic Growth in Asia, *American Journal of Applied Sciences*, 5, 203-208.

Yosef H. (1988) A Sharper Bonferroni Procedure for Multiple Tests for Significance, *Biometrika*, 49, 297–303.